WIRE AND WIRE PRODUCTS

SEPTEMBER 1961

Vaughn® HORIZONTAL **STATIONARY BLOCKS** *deliver*

Vaughn Horizontal Stationary Blocks provide versatile wire coiling and snarl free packaging. Horns are self-supported by BACK GEARING—eliminating holding with hooks or stems—minimizing operator attention—assuring maximum safety—and providing for FUTURE AUTOMATED SET-UPS. Write us on your most demanding coiling needs.

THE VAUGHN MACHINERY COMPANY
Cuyahoga Falls, Ohio

COMPLETE COLD DRAWING EQUIPMENT—Continuous or Single Hole . . . for the Largest Bars and Tubes . . . for the Smallest Wire . . . Ferrous, Non-Ferrous Materials or their Alloys

OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION

COULTER & McKENZIE

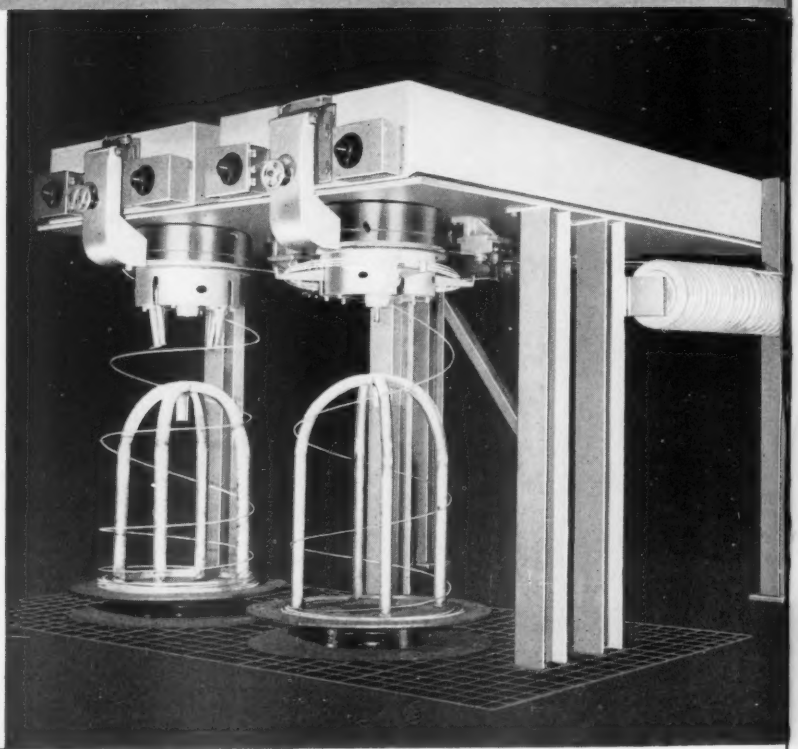
ANNOUNCES THE WIRE INDUSTRY'S MOST VERSATILE TAKE-UP & WIRE PACKAGING MACHINE!

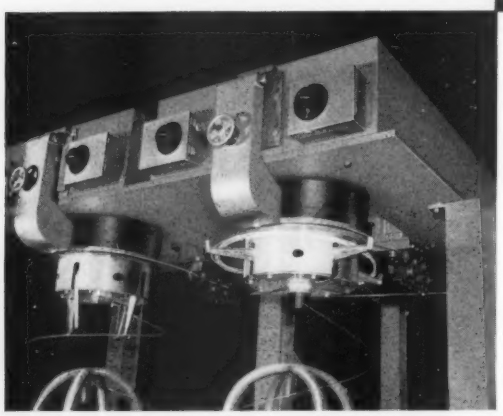
Vari-Coil

For PATENTING
ANNEALING
GALVANIZING
ENAMELING
TINNING
FINAL DRAW

- √ Non-Stop Package Changing
- √ Package Sizes to 4,000 lbs.
- √ Coil Diameters to 36″
- √ Speeds Infinitely Variable
- √ Wire Size to ⅜″ (.375″)
- √ Ferrous and Non-Ferrous Materials Including High Carbon Steel

THERE IS A SIZE FOR ALL APPLICATIONS. SINGLE OR MULTIPLE UNITS FOR YOUR INDIVIDUAL JOB.





For information concerning your application, please write or telephone.

1 INFINITELY VARIABLE RANGE OF COIL SIZES
a. All sizes wire from same capstan.
b. Current models with coil ranges 16″ to 26″ and 24″ to 36″ without changing blocks.
c. Coil sizes may be altered without stopping.

2 GREATER COIL WEIGHTS
a. Turn tables accommodate coils, drum paks and stems (200 to 1200 lbs.)
b. Oversize loads on handling pallets (1000 to 4000 lbs.)

3 INCREASED RANGE OF WIRE AND ROD SIZES
a. Precise cast control of fine wire to coarse rod.
b. No axial twist.

4 ACCUMULATOR HEAD PROVIDES INTERVAL FOR STRIPPING AT OPERATOR'S CONVENIENCE
a. Accumulator operating in conjunction with main take-up block is key to uninterrupted constant speed take-up.
b. Operator has 5 to 10 minutes accumulation time for stripping finished package from turn table.

This equipment manufactured under one of the following U. S. Patents 2,732,060; 2,868,474; 2,844,416; 2,868,268; 2,981,494 or others pending.

Barron & Crowther Ltd., Eastleigh, Hants, England. European Draw-Pak Licensee Idos Industries Ltd., Royston, Herts, England. Sales Agents.

35 UNION AVENUE

TELEPHONE EDISON 5-1101
LIEBER'S CODE "MACKENZIE"

THE COULTER & McKENZIE MACHINE CO., INC.

BRIDGEPORT 7 CONNECTICUT U. S. A.

SINCE 1942 INCORPORATED 1951

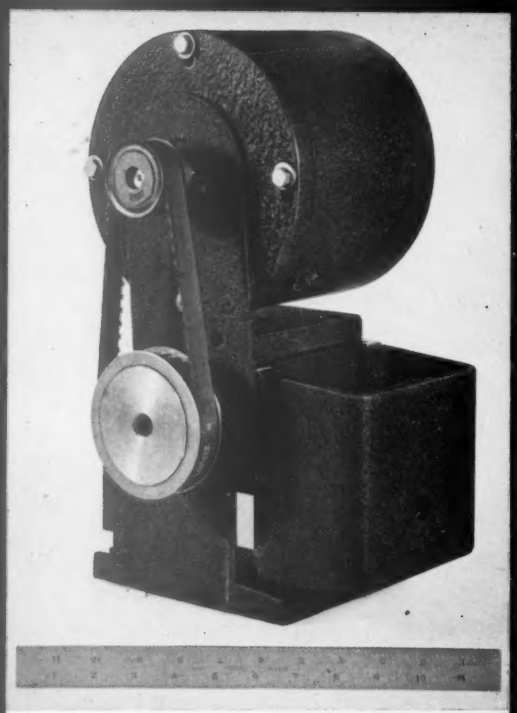
ROTATING DIE HOLDER

model R. O. no. 1

designed and engineered by

STANDARD INDUSTRIAL

FRANKFORT, ILLINOIS



COMPLETE UNIT WITH LUBE BOX
BELT GUARD REMOVED

PRICE PER UNIT $450.00
F.O.B. POINT OF SHIPMENT

STANDARD SPECIFICATIONS

POWER —½ h.p. motor 110 single-phase or 220 3-phase

WEIGHT — 110 lbs. complete with 1.7 qt.-capacity lubricant box.

SPEED — 43 or 86 R.P.M.

DRIVE — Notch belt quiet drive. May be driven forward or reverse.

OLITE BEARINGS — Permanent lubrication.

Timken Roller Bearings used throughout.

Tool Steel Gear and Worm.

All moving parts machine ground.

Standard Die Cavity, 2" diam., 1⅜" depth.

Thrust Load 11000 lbs. at 43 R.P.M.

Cooling — Teflon Sealed Water-Cooled Die Chamber.

Threaded Die Retainer Cap with Spanner Wrench.

SERVICE ★ INTEGRITY
DEPENDABILITY

DRIVE GUARD REMOVED SHOWING
BELT DRIVE AND DIE ADAPTERS

HOW TEAMWORK MET GOVERNMENT SPECIFICATIONS FOR MISSILE CABLE APPLICATION

Berkshire Electric Cable Co., Leeds, Massachusetts, leading manufacturer of electric cable for aircraft and electronics, called on The Blane Corporation, Canton, Mass., to develop a vinyl insulation compound to meet the specifications of MILW 16878C, types B, C, and D.

Berkshire specified that the compound must meet the thin wall as well as heavy wall applications, requiring a temperature range of 105° to −55° C, with an excellent margin of safety.

The result of Blane's insulation specialists working closely with Berkshire engineers is Blane No. 2100 Compound. This quality material combining excellent high temperature properties, superior low temperature characteristics, outstanding electrical properties, superbly does the job of meeting MILW 16878C and other government specifications such as MILW 5086A and NAS 702.

We invite other wire and cable manufacturers to avail themselves of the services of the Blane Research and Development Program without obligation.

Using the Blane Teamwork approach can produce results that spell progress and profit for your company.

HUSKY • CABLE

Berkshire
ELECTRIC CABLE CO.

THE BLANE CORPORATION
CANTON, MASSACHUSETTS

Blane

PARTS "BORN" TO shape!

Cold-formed from wire, these difficult-to-make parts now bring substantial savings.

Production — automatic, high speed, efficient.

Stock — economical coiled wire.

Scrap — minimum; none in many cases.

Finishing operations — few; some parts ready to use.

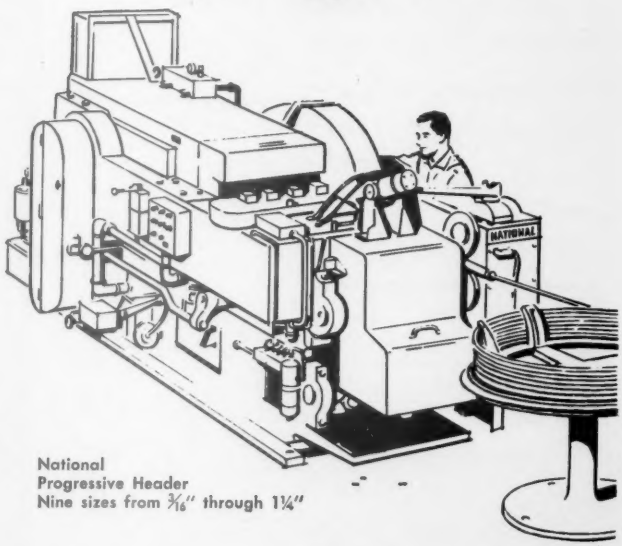
Quality — the best; forged strength and reliability.

Savings — of material and time.

NATIONAL PROGRESSIVE HEADERS are now able to form many unusual shapes automatically, because you have (1) Better coiled wire; (2) Improved die materials and lubricants; (3) Economy-minded engineers designing for cold forming; (4) Engineering assistance to help you flow metal.

If you make odd-shaped parts, come to Tiffin, and let us help you evaluate them for production from wire.

No obligation.



National
Progressive Header
Nine sizes from 3/16" through 1¼"

FORGING MACHINES • MAXIPRESSES • REDUCEROLLS
BOLTMAKERS • NUT FORMERS • TAPPERS
COLD HEADERS • PARTS-MAKING MACHINES

NATIONAL MACHINERY CO.

TIFFIN, OHIO, U. S. A.

HARTFORD DETROIT CHICAGO

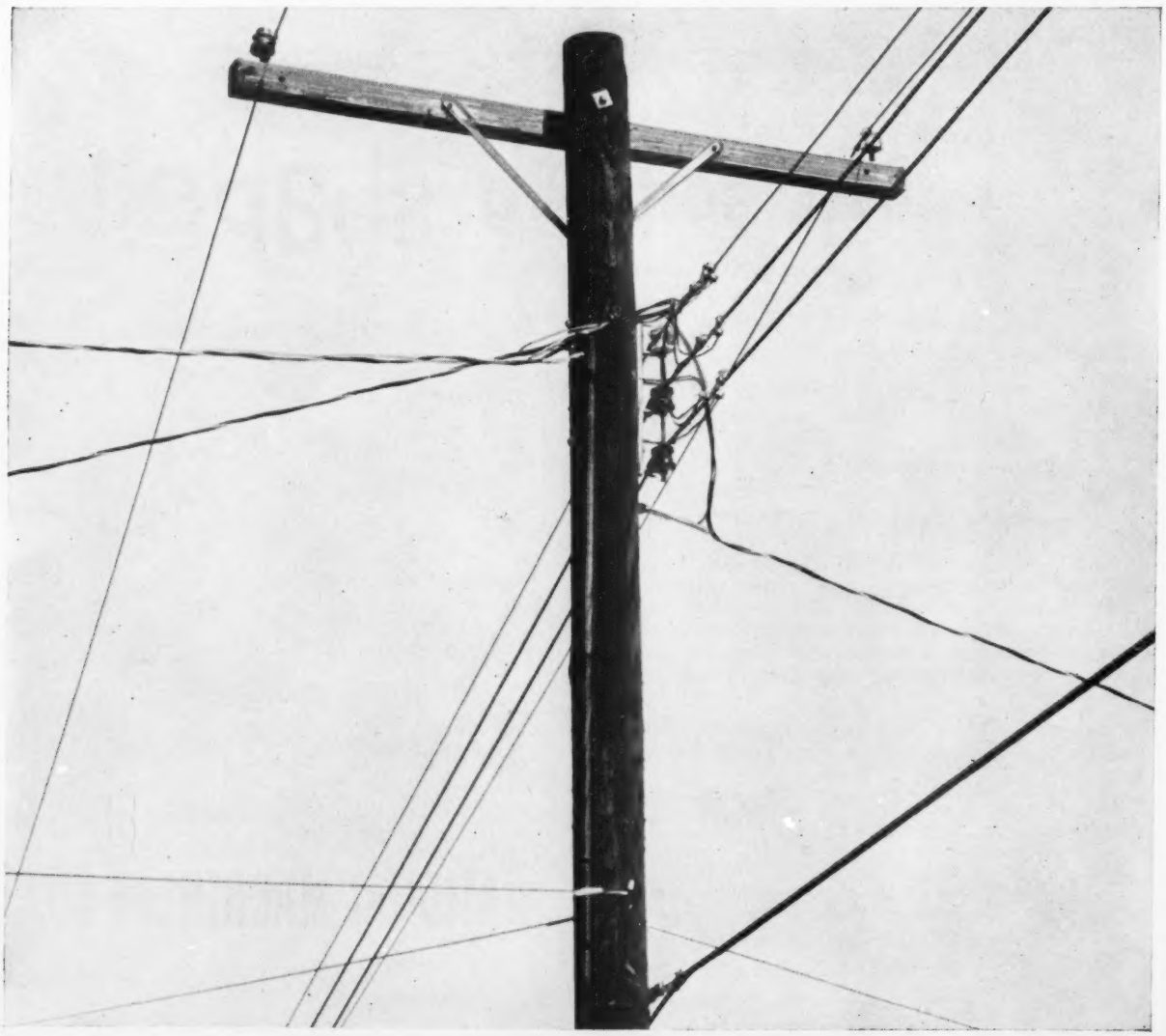
for the right number in line and drop wire insulation...

Monsanto Polyethylene compounds MPE 12 and MPE 11302 help make line and drop wire insulation economical to use and maintain because they impart superior weather-aging characteristics, good abrasion resistance, and resistance to fatigue, insuring long service life. MPE 12 and MPE 11302 contribute to excellent appearance—smooth surface, good gloss, and excellent carbon black dispersion.

Both offer fast extrusion rates. You can be sure of product uniformity because of Monsanto blend to blend uniformity. These resins impart good physical and electrical properties, meeting all applicable A.S.A. and IPCEA specifications.

Monsanto Polyethylene formulations are based on long experience in supplying the specialized needs of the Wire and Cable Industry. MPE 12 and MPE 11302 are but two in Monsanto's range of polyethylene resins developed for wire insulation. For more information, write to Monsanto Chemical Company, Plastics Division, Room 827, Springfield 2, Mass.

Monsanto



WIRE AND WIRE PRODUCTS*

A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable.
DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 36 September, 1961 No. 9

Designated as Official Publication By The Wire Association

Contents

The Wire Outlook 1131

The Logarithmic Function of Equi-Reductions in Multiple Drawing Operations
by Anton F. Mohrnheim 1133

The Importance of Wire in Spring Design
by Hal McVey 1141

Polymer Requirements and Insulating Techniques for Obtaining the Maximum Benefits of High Density Polyethylene
by R. J. Ettinger 1142

New Developments in Wetting Agents
by Carl Alex Fischer 1146

Method for Tripping Power Circuit Breakers
by H. B. Ashenden 1149

Plastic Ventilating System on Wire Coating Line Replaces Wood to Advantage 1151

Wire Kinks ..... 1153 and 1155

Improved Method of Production for Flattened Strand Ropes
by Leo Walter 1157

The Wire Association Annual Convention Program 1159-1162

Outstanding Personalities of the Wire Industry 1170

A Review of Recent Wire Patents 1177

Index to Advertisers 1199

Where-to-Buy 1200-1204

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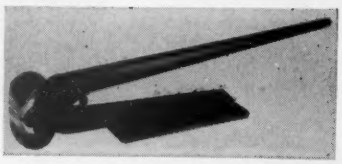
NEW

CAREW BENCH CUTTER



Bolt to Bench or Machine

One Hand Use

Doesn't tie up vise or other expensive makeshift

It can't get lost when bolted to bench

Same replaceable tool steel jaws as our regular cutters

STOCKED BY MOST MILL SUPPLY DEALERS

made by

M. W. ROBINSON CO., INC.

ROCKFALL, CONN., U.S.A.

Please feel free to consult us with your wire cutting problems.

Nelco coated wire stands up to the elements

What's the "hidden ingredient" you look for in a lacquer? It's the organization behind it. Research. Testing facilities. Pilot plant runs. Production capacity. And of course experience.

That's what makes Nelco lacquers the *lacquers with a difference*. They're not just "mixed" — they're carefully *formulated* to make certain they'll meet your strictest specifications.

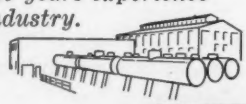
Of our hundreds of stock formulations for wire and cable coating, we've listed a few here. With our unique facilities we can *custom* formulate still others to meet special requirements.

Send for the Nelco Data Book. You'll have facts — at your fingertips — for every construction. Or send us information on your coating problems.

Look at this array of lacquers. High temperature resistant. Clear, glossy film. Flame retardant. Fray prevention. MIL spec. finishes. Fungus resistant.

NL 7147 Nelco Clear Cable Coating
NL 8223 Nelco Clear Heat Resistant Cable Coating
NL 9731 Nelco Flame Retardant Saturant
NL 8211 Nelco Moisture Resistant Saturant
NL 9776 Nelco Clear Cellulose Acetate Cable Coating
R 4026 Nelco High Temperature Resistant Cable Coating
R 5979 Nelco Clear Nylon Cable Coating
R 6625 Nelco Ribbon Cable Adhesive

Back of Nelco lacquers are 40 years experience serving the wire and cable industry.

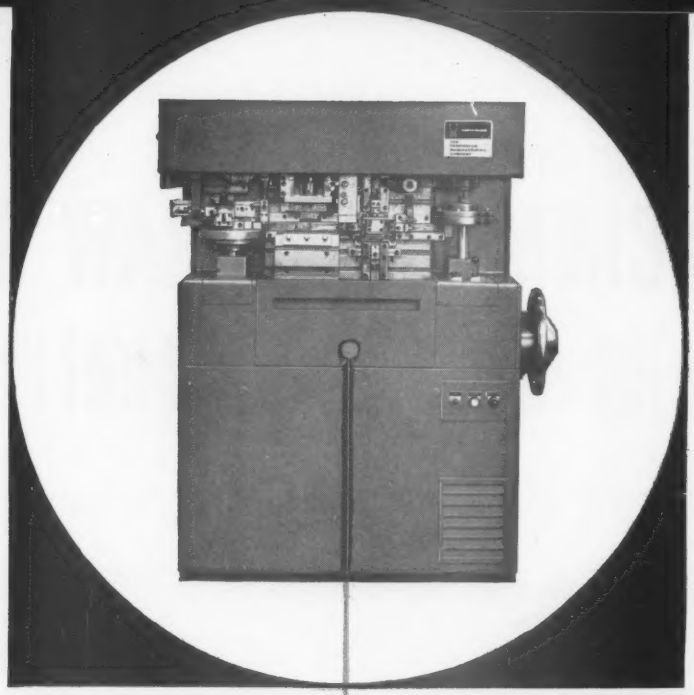


Nelco LACQUERS

Not just mixed ... they're formulated

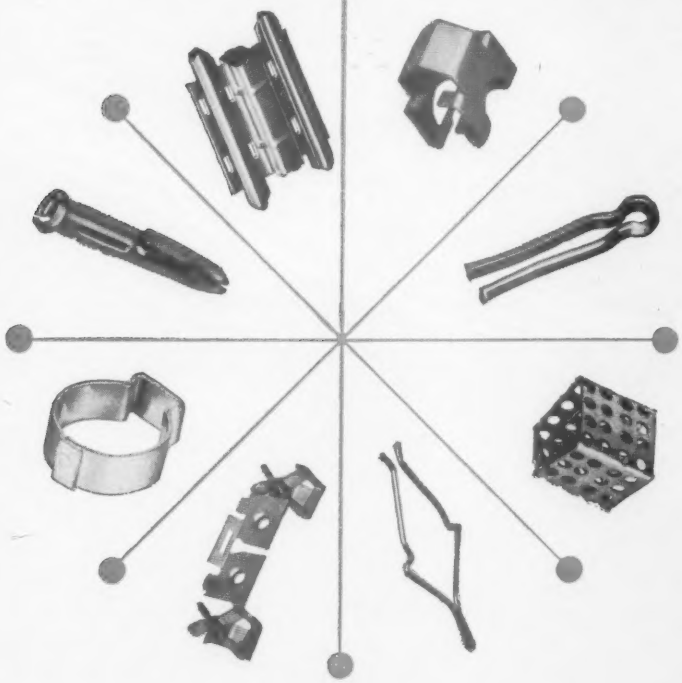
CP

NELCO LACQUER DIVISION, **CHEMICAL PRODUCTS CORPORATION**, EAST PROVIDENCE, RHODE ISLAND



This is the machine

These are its products



If you recognize parts like these you should be familiar with this machine

The machine is a **Verti-Slide.** It can press, punch, and form in one continuous operation — and in addition, weld, thread roll, swage and do other secondary work. If you now use or supply small parts, made from wire or strip stock, the **Verti-Slide** method can offer you many dramatic production advantages. To evaluate your need write today for our **Parts Cost Package.**

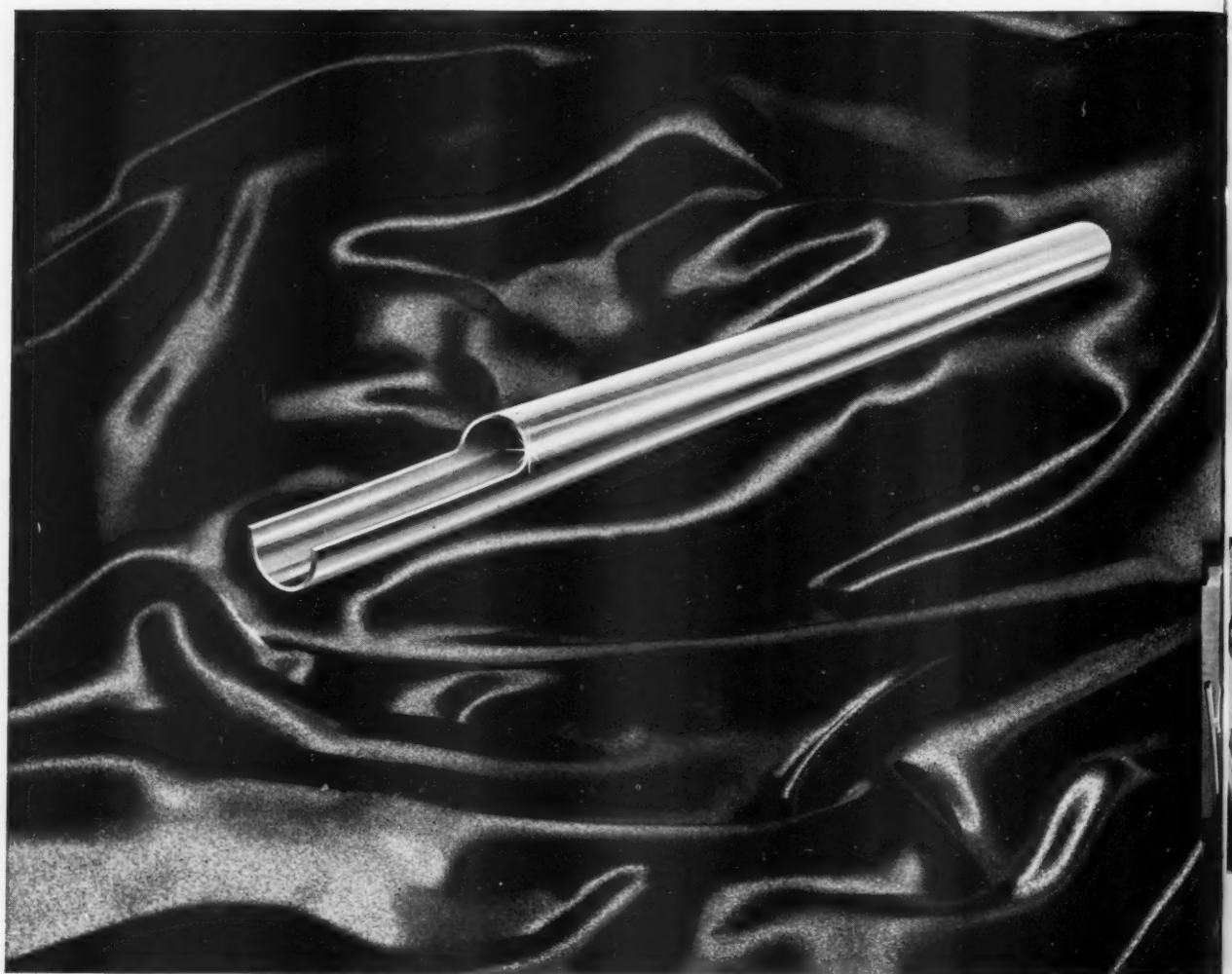
TORRINGTON

MANUFACTURING COMPANY

MACHINE DIVISION – TORRINGTON, CONNECTICUT

Take a lead from the leaders...

AMCHEM GRANODRAW SS* No. 16 Finish of Stainless Steel Tubing at



Consistent attention to quality production is rapidly achieving a reputation as the "Tiffany of the industry" for Summerill Stainless Tubing. Amchem's Granodraw SS No. 16 is an integral part of the quality story that has created favorable impact for this far-sighted industry leader.

Improves Drawability and Surface Summerill Stainless Tube Division

New Granodraw SS No. 16 Oxalate Coating Operates More Efficiently Regardless of Pre-Treatment

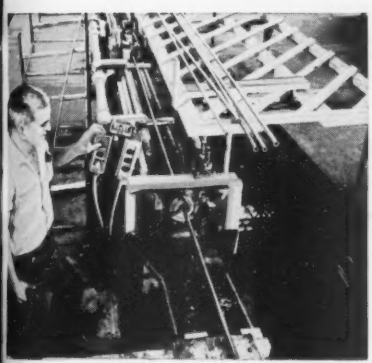
At Summerill Stainless Tube Division of Columbia Steel & Shafting Company introduction of a new Amchem Granodraw SS coating has greatly increased tube drawing efficiency and improved the quality of Summerill's tube surfaces. Summerill, well known for smooth, low micro-inch I.D., mandrel drawn and bright annealed surfaces makes strong demands on coating and drawing compounds.

In operation only a short time the Granodraw SS No. 16 process is virtually paying for itself in reduced scrap loss—the result of its amazing adaptability to operate efficiently regardless of the pre-treatment or pickling process involved prior to coating. Proof of performance, too, is the fact that Granodraw SS No. 16 operations at Summerill have resulted in substantial reduction in competitive chemical costs—with improved drawability and I.D. and O.D. quality.

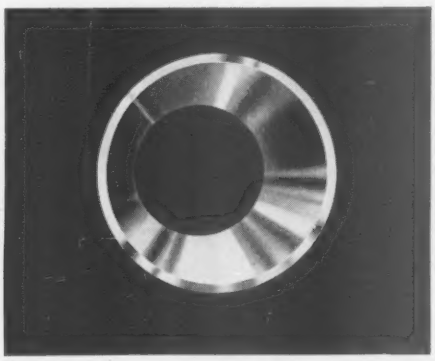
Built-in features of Granodraw SS No. 16 also accrue to Summerill's advantage—chloride and fluoride free coating, easily controlled two (2)' chemical process which consistently produces an exceptional I.D. and O.D. finish that meets the most critical standards in the tube drawing industry.

If you draw, extrude or cold form stainless steel, you should investigate the operational advantages and end product benefits of Granodraw SS No. 16. Your local Amchem Representative is as near as the telephone!

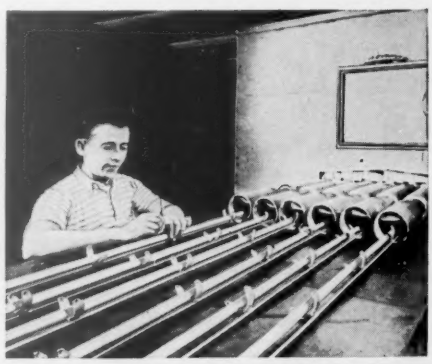
*Amchem's registered trademark for its conversion coating chemical for stainless steel.



Mandrel drawing at Summerill. This method of cold-reduction produces the fine finishes and exact tolerances found in every Summerill tube.



The exceptionally bright finish achieved on Summerill Stainless Tubing is often referred to as "The New Look Inside."



Summerill Stainless Tubing entering the bright-annealing furnace. Note the brightness even before bright-annealing.

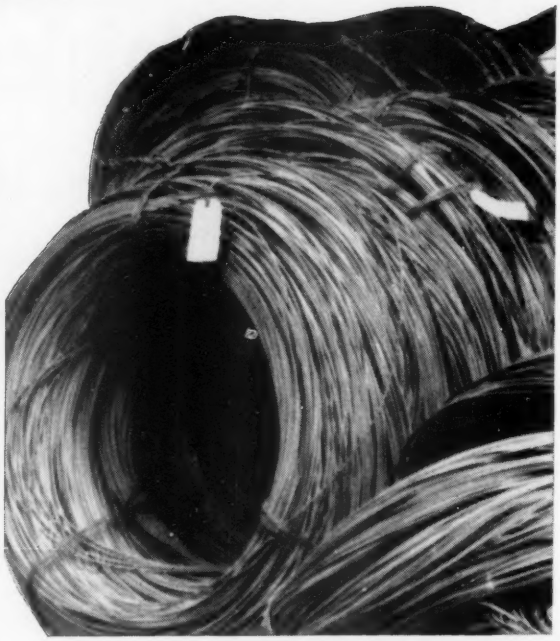
AMCHEM **GRANODRAW SS No. 16**

Amchem and Granodraw are registered trademarks of
AMCHEM PRODUCTS, INC. (Formerly American Chemical Paint Co.)
AMBLER, PA. • Niles, Calif. • Detroit, Mich. • St. Joseph, Mo. • Windsor, Ont.

Operation: Descaling

(One of a series)

Drawn and annealed wire descaled up to 800 feet per minute



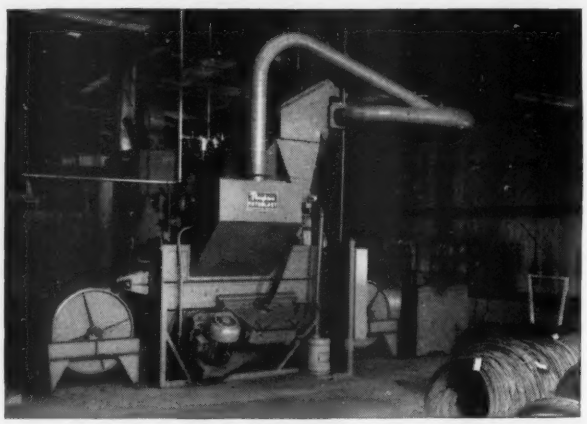
Hot rolled rod descaled at 200-600 feet per minute

These figures speak for themselves!

Compare these speeds with your own descaling performance. Then consider this: fast descaling time is only one of many reasons why Pangborn Rotoblast cuts your costs.

Here are some other specifics: Rotoblast eliminates loss of virgin metal . . . ends acid disposal problems . . . requires less space . . . reduces original investment by as much as 70% over pickling equipment. Rotoblast descaling equipment goes to work at the touch of a button. Because it is a dry process, it is absolutely non-toxic, an important aid to employee morale. Rotoblasting gives an improved surface for application of lubricant.

You save money other ways, too. You can maintain Rotoblast more easily. Because Rotoblast Cabinets are fully lined with wear plates, you never have to replace the cabinets themselves. All three wheels of the Rotoblast units assembly are fully exposed and easily accessible—not locked up inside the equipment. Overall result: lower operating costs, lower maintenance costs.

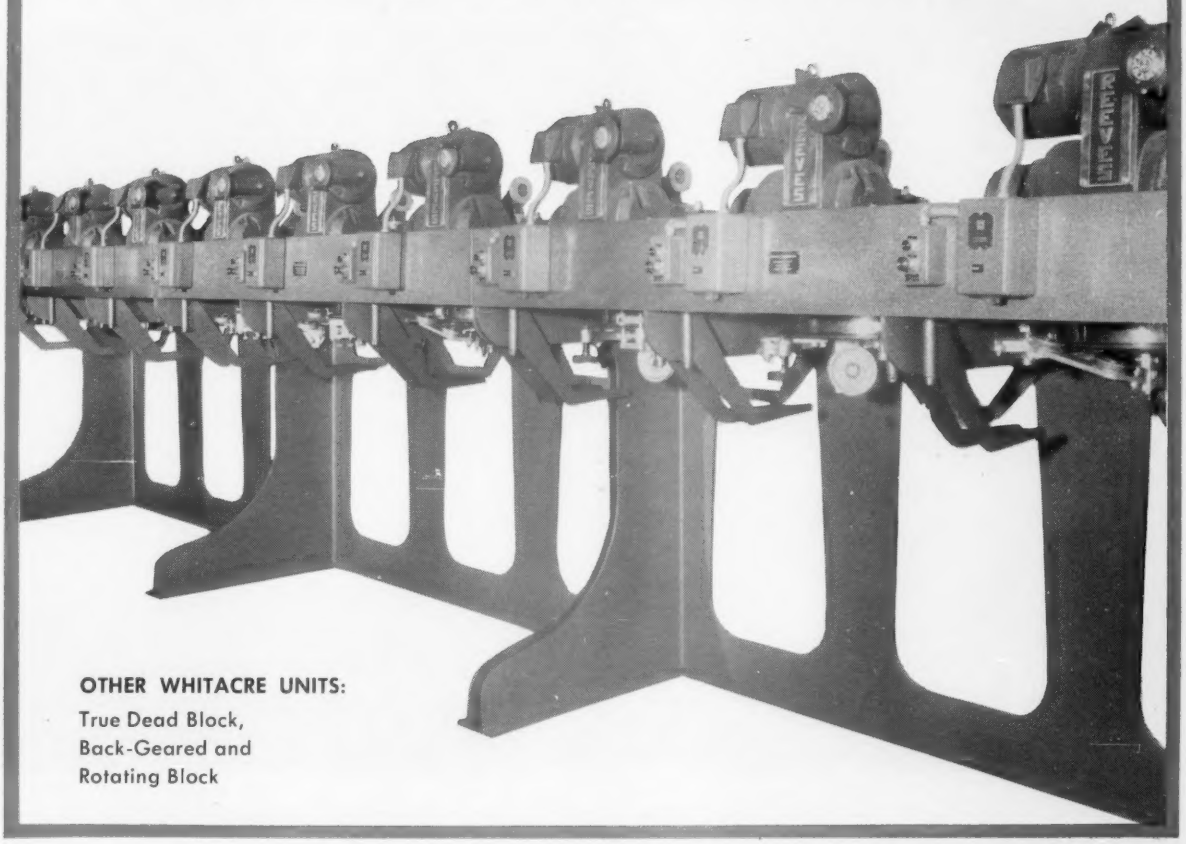


Pangborn

OF HAGERSTOWN

For more detailed information, write: PANGBORN CORPORATION, 5400 Pangborn Blvd., Hagerstown, Md.; Pangborn Canada, Ltd., 47 Shaft Rd., Toronto (Rexdale), Canada—*Manufacturers of Blast Cleaning, Vibratory Finishing, Dust Control Equipment; Rotoblast® Steel Shot and Grit®.*

9 Reasons to Specify
WHITACRE TAKE-UP FRAMES



OTHER WHITACRE UNITS:
True Dead Block,
Back-Geared and
Rotating Block

1. Heavy duty construction designed for continuous 24-hour maintenance-free operation. Driven by worm gear reduction unit. Plated mechanism to resist corrosive action of flux tank fumes.
2. Wide speed range allows processing a diversity of products.
3. Provides perfect lay and cast.
4. Adaptable to any type container.
5. Allows tangle-free packages of wire of greater weights.
6. Simple string-up and adjustment. Both killing and casting adjustment can be made "on the fly."
7. Wide range of interchangeable block sizes.
8. Easily installed. 60-90 day delivery.
9. Low initial investment and operating costs.

TYPICAL INSTALLATIONS

Bethlehem Steel Corp.
Colorado Fuel and Iron Corp.
U.S. Steel Corp.
Laclede Steel Company
Union Wire Rope, Armco Steel Corp.
Western Electric Co.
Wire Machinery, Inc.

WHITACRE

For Complete Information, Write:

WHITACRE CORPORATION

5649 Alhambra Ave. • Los Angeles 32, Calif. • CApitol 5-2476

SILICONES

Three months on the shelf...

YET NEW SE-9008 SILICONE RUBBER WIRE AND CABLE COMPOUND CAN STILL BE USED WITHOUT MILLING!

General Electric's non-milling silicone rubber compound SE-9008 is the *only* quality wire and cable compound you can buy that keeps freshened life *for three full months!* You can now cut way down on your processing costs, and provide wire and cable with high performance capabilities at moderate cost.

SE-9008 comes in coiled "hats" ready to feed *automatically* into your extruder. No pre-milling, no modifications, no special dies required.

Strips comes 2" wide, and either ½" or ¼" thick, whichever you require. Available for either hot air or steam vulcanization.

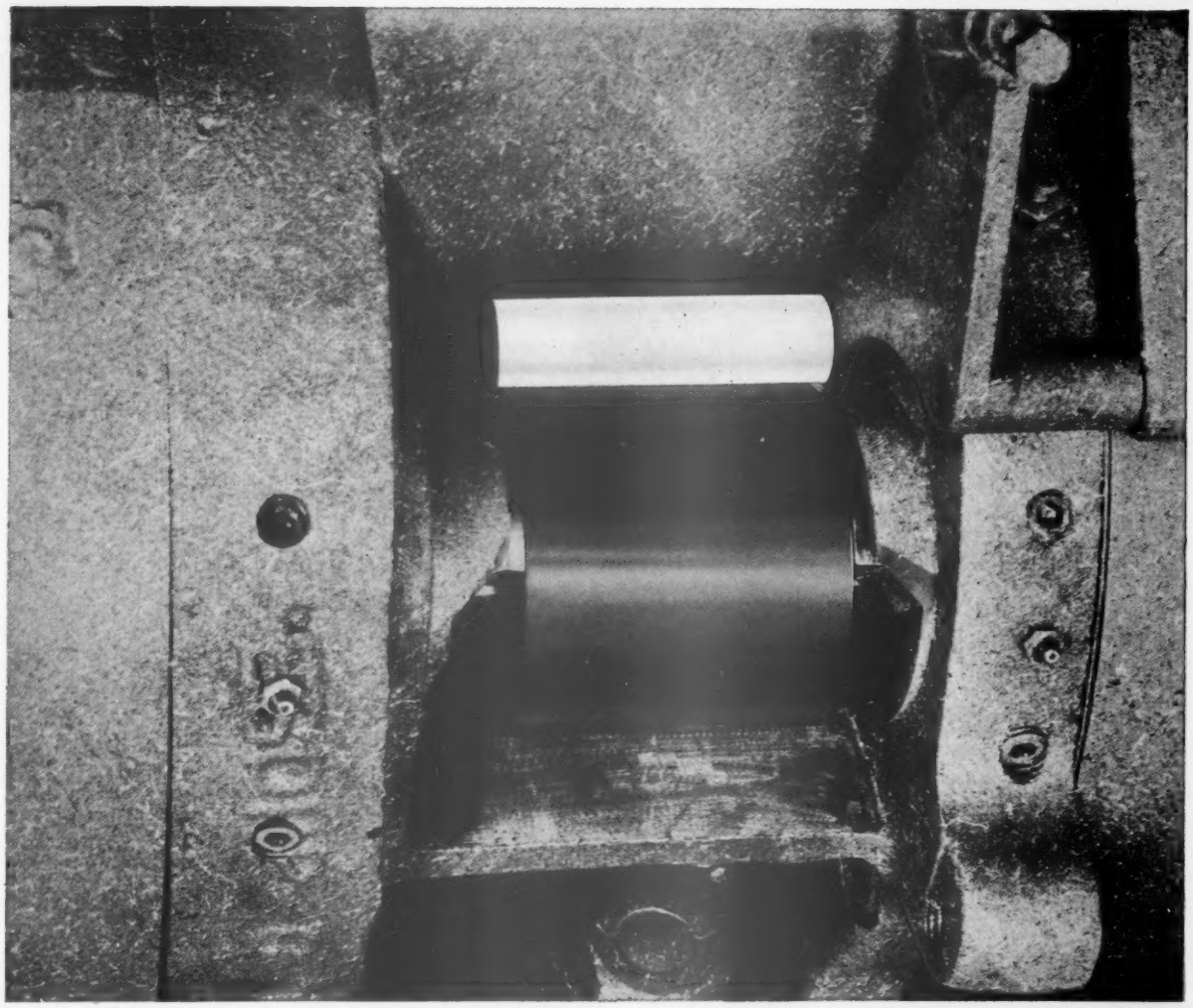
SE-9008 is excellent for power cable, fixture wire, motor and apparatus wire, and other commercial and military applications.

SE-9008 is moderately priced, and possesses good electrical and physical properties. Meets Underwriters Laboratory requirements for silicone rubber insulated fixture wire.

SE-9008 is another cost-saving product from General Electric, who supplies more silicone rubber for wire and cable insulation than all the other suppliers *combined!*

For more information on SE-9008, write: General Electric Company, Silicone Products Department, Section VV951, Waterford, New York.

GENERAL ELECTRIC



Royle Extruders Increase Room Temperature Feeding Efficiency

Those working with room temperature feeding are familiar with the many economic advantages this method offers.

Royle Extruders are designed to *utilize* and *increase* these advantages to the utmost.

As an example: the Royle Constant Pressure Roller Feed Hopper — with its new adjustable spring-loaded Teflon roller — assures closer tolerance control. It gives improved product density by eliminating porosity and cuts down rubber waste.

The new Royle Constant Pressure Roller Feed Hopper is available on all size Royle Extruders.

Write today for full information on Royle Rubber Extruders.

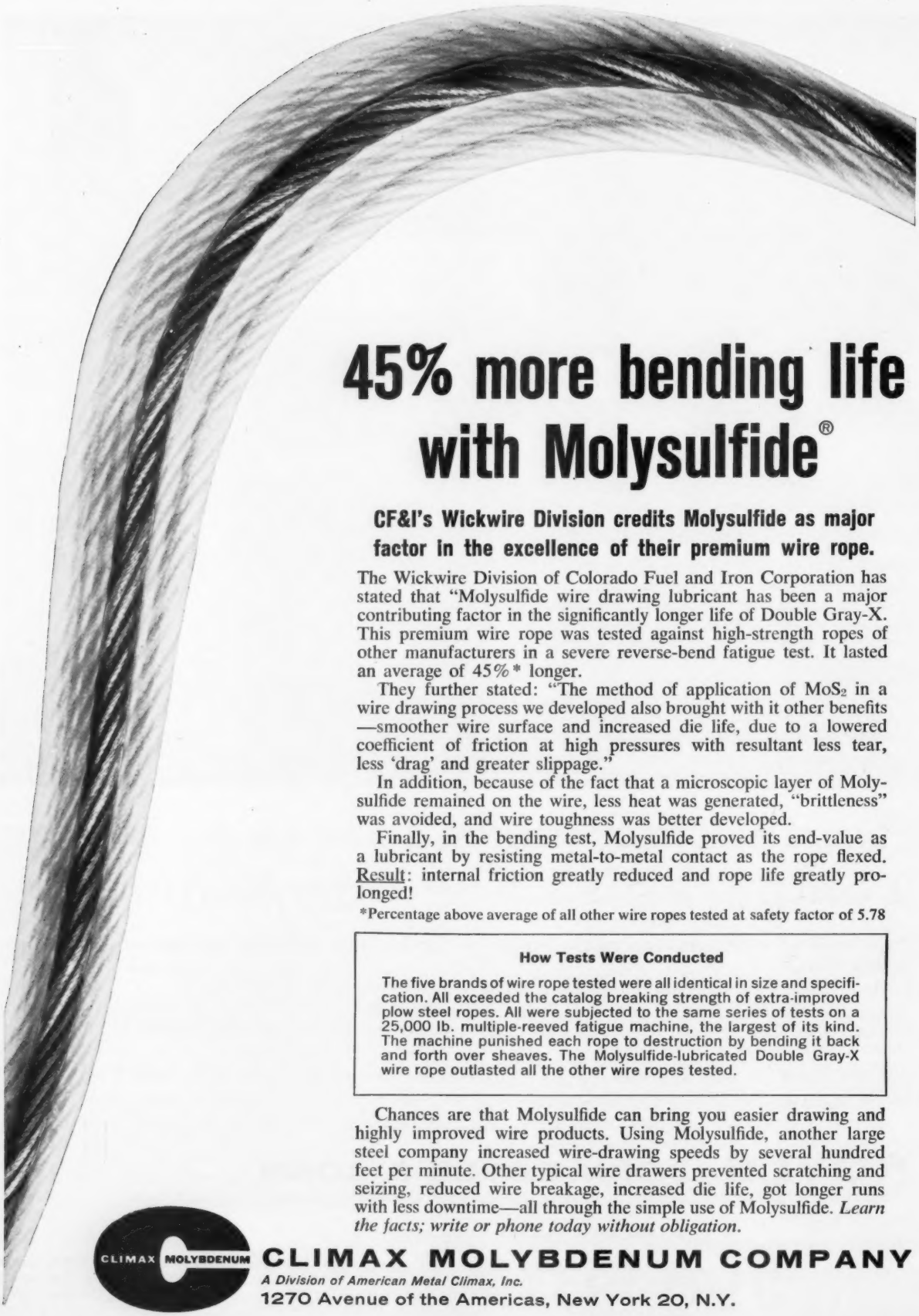
ROYLE
Paterson, N. J.

JOHN ROYLE & SONS

Pioneered the Continuous Extrusion Process in 1880

10 Essex Street, Paterson 3, New Jersey

Tudor Road, Wealdstone, Middlesex, England, James Day (Machinery) Ltd., Harrow 2655-6. **Home Office,** V. M. Hovey, J. W. VanRiper, SHerwood 2-8262. **Akron, Ohio,** J. C. Clinefelter Co., Blackstone 3-9222. **Downey, Cal.,** H. M. Royal, Inc., TOpaz 1-0371. **Tokyo, Japan,** Okura Trading Company, Ltd., (56) 2130-2149.



45% more bending life with Molysulfide®

CF&I's Wickwire Division credits Molysulfide as major factor in the excellence of their premium wire rope.

The Wickwire Division of Colorado Fuel and Iron Corporation has stated that "Molysulfide wire drawing lubricant has been a major contributing factor in the significantly longer life of Double Gray-X. This premium wire rope was tested against high-strength ropes of other manufacturers in a severe reverse-bend fatigue test. It lasted an average of 45%* longer.

They further stated: "The method of application of MoS_2 in a wire drawing process we developed also brought with it other benefits —smoother wire surface and increased die life, due to a lowered coefficient of friction at high pressures with resultant less tear, less 'drag' and greater slippage."

In addition, because of the fact that a microscopic layer of Molysulfide remained on the wire, less heat was generated, "brittleness" was avoided, and wire toughness was better developed.

Finally, in the bending test, Molysulfide proved its end-value as a lubricant by resisting metal-to-metal contact as the rope flexed. Result: internal friction greatly reduced and rope life greatly prolonged!

*Percentage above average of all other wire ropes tested at safety factor of 5.78

How Tests Were Conducted

The five brands of wire rope tested were all identical in size and specification. All exceeded the catalog breaking strength of extra-improved plow steel ropes. All were subjected to the same series of tests on a 25,000 lb. multiple-reeved fatigue machine, the largest of its kind. The machine punished each rope to destruction by bending it back and forth over sheaves. The Molysulfide-lubricated Double Gray-X wire rope outlasted all the other wire ropes tested.

Chances are that Molysulfide can bring you easier drawing and highly improved wire products. Using Molysulfide, another large steel company increased wire-drawing speeds by several hundred feet per minute. Other typical wire drawers prevented scratching and seizing, reduced wire breakage, increased die life, got longer runs with less downtime—all through the simple use of Molysulfide. *Learn the facts; write or phone today without obligation.*

CLIMAX MOLYBDENUM

CLIMAX MOLYBDENUM COMPANY

A Division of American Metal Climax, Inc.

1270 Avenue of the Americas, New York 20, N.Y.

CUT WIRE COSTS UP TO 60%!

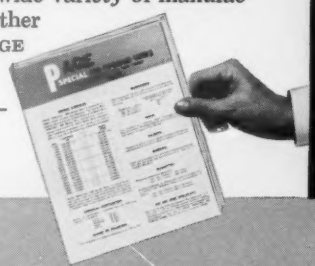
...with Page Special HB

If you are now using music wire, or if you have been prevented from using it because of its high cost, it makes good sense to investigate PAGE *Special* HB. In every case, the tensile strengths of *Special* HB approach those of music wire—and in sizes .090″ and coarser equals them! Moreover, *Special* HB costs as much as 60% less than music wire.

A hard-drawn, high-carbon steel wire, *Special* HB is available in galvanized or bright finishes and in diameters from .020″ to .162″. We'll be glad to send you the full story, including a detailed comparison of tensile strengths.

As America's leading special-purpose wire mill, PAGE can supply a wide variety of manufacturers wire items with just the tensile strength, ductility, finish and other properties you need. Tell us your requirements—we'll recommend a PAGE wire to help you reduce costs and improve your product.

Write us at Monessen, Pa. for Booklet **DH-107** on *Special* HB—or for information on what PAGE has to offer to meet your other wire requirements.



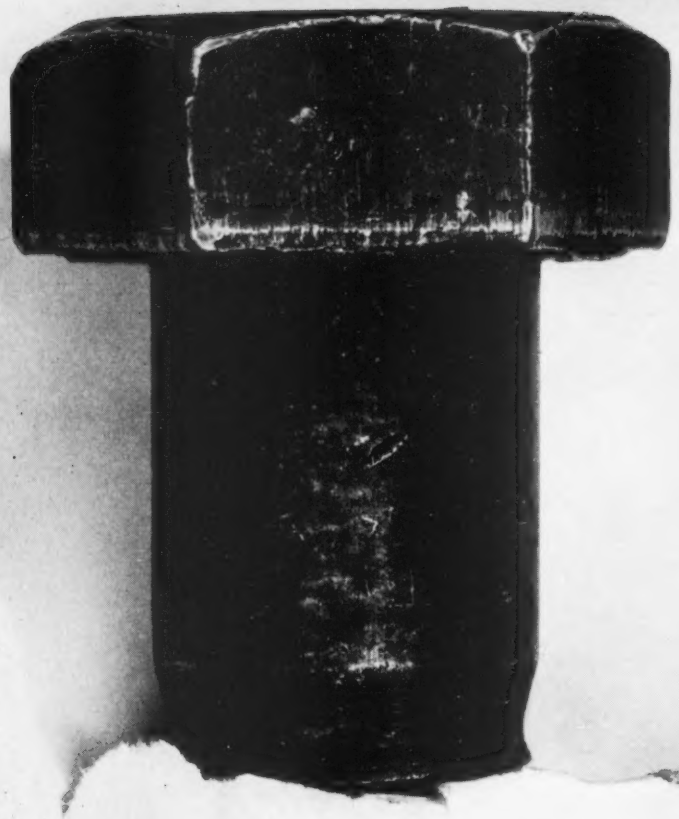
PAGE

the source for answers to wire problems

ACCO

PAGE STEEL AND WIRE DIVISION • AMERICAN CHAIN & CABLE COMPANY, INC.

Monessen, Pa., Atlanta, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Bridgeport, Conn.



Bolts are better now because wire and rod used in their manufacture have a consistent quality and uniformity coil after coil. This is principally because of the constant innovations made in wire and rod processing equipment by the *Lee Wilson Engineering Co., Inc., 20005 Lake Road, Cleveland 16, Ohio. Remember the name.*

Lee Wilson

AMERICA'S FOREMOST BUILDERS OF ANNEALING EQUIPMENT

Keystone Wire solves dairy brush forming and corrosion problems

Uniform wire softness is needed to perform brush twisting operations on high-speed twisting machines. To solve this problem, Keystone Steel & Wire Company developed for Regal Manufacturing Company, Fond du Lac, Wisc., a dead soft galvanized twisted Brush Handle Quality Wire. A special tight zinc coating is designed to adhere firmly during the severe twisting.

Regal Manufacturing Company specializes in making unusual brushes for the dairy and creamery industry—for example, the milking machine brush illustrated at left.

For filled brushes, galvanized stapling wire anchors crimped white nylon bristles into brush blocks of Super Hi-Impact plastic, hard rubber and hard wood. Regal uses Keystone's galvanized Stapling Quality Wire to resist corrosion from water and lactic acid.

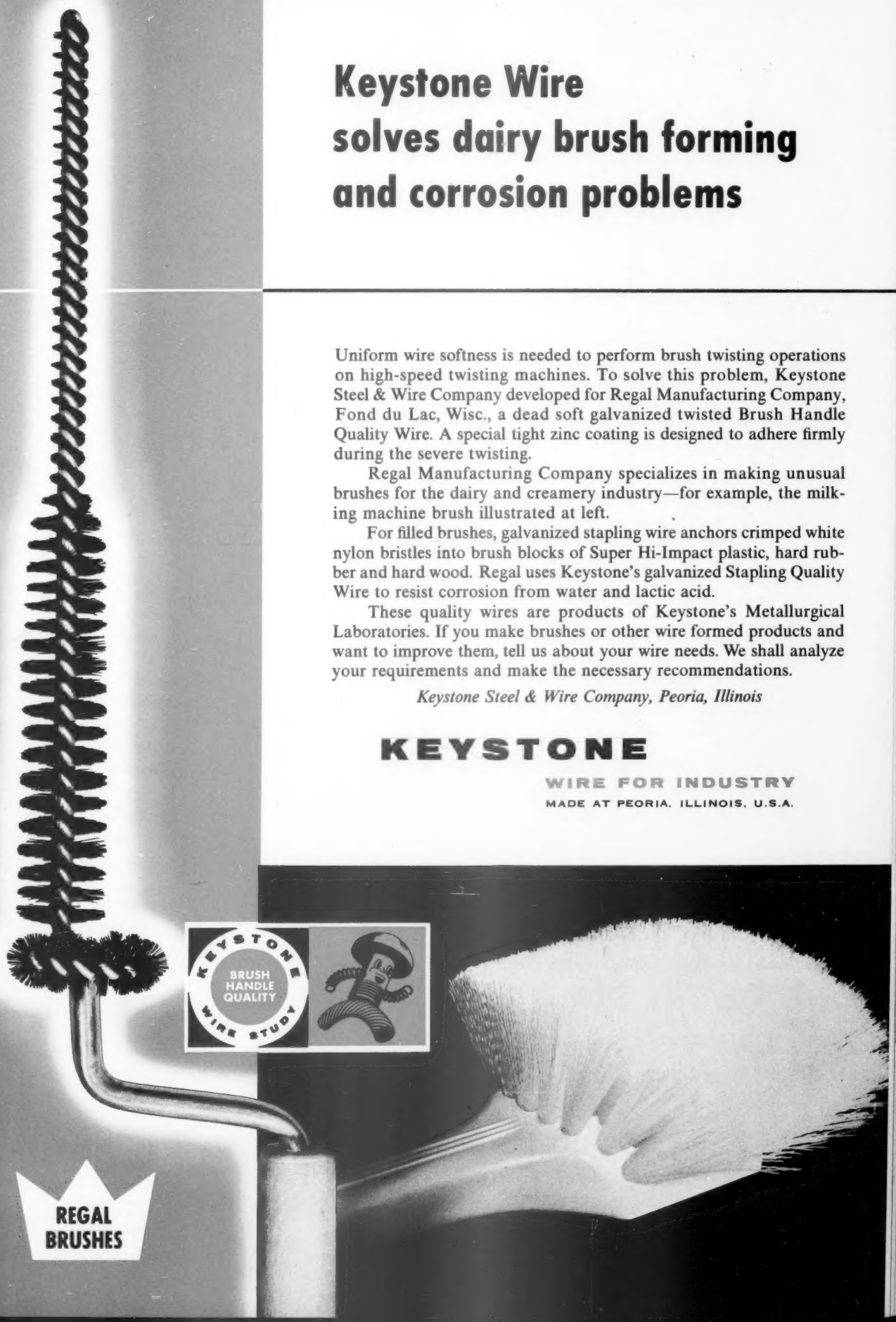
These quality wires are products of Keystone's Metallurgical Laboratories. If you make brushes or other wire formed products and want to improve them, tell us about your wire needs. We shall analyze your requirements and make the necessary recommendations.

Keystone Steel & Wire Company, Peoria, Illinois

KEYSTONE

WIRE FOR INDUSTRY

MADE AT PEORIA, ILLINOIS, U.S.A.



CONTINUOUS COILING AND PACKAGING

direct from your process line

with the

TA15 CONTINUOUS COILER (Available in U.S.A.)

- A compact combination of the latest techniques in mechanical, pneumatic and electronic engineering.
- Completely self contained. Will follow process line automatically without interlock connections.
- Four completed coils per minute.
- Complete and automatic checking, with automatic handling into individual boxes and automatic faulty coil rejection.
- Accurate length control, quickly changed for varying coil sizes and sections.
- Powered cutting.
- Tight, well layered coils.
- Automatic spray and oil bath lubrication.
- Automatic interlocks to keep down-time to a minimum.
- Machine tool construction.

This continuous coiling version of the 'TA.15' has been subjected to, and perfected under, continuous production conditions for two years, with the co-operation of one of our customers, Les Cables de Lyon, France.

'TA.15's' are now operating, and are being installed in North America and most of the major countries of Europe.

North and South America,
Manufacturing Associates, Michigan Oven Co., Detroit, U.S.A. All products.

France.
Licensed manufacturers, Les Cables de Lyon, Bezons. 'TA.15' only.

All inquiries are welcomed and our engineers are available to assist you in planning your automatic plant.

Return the coupon below to —

GENERAL ENGINEERING CO (RADCLIFFE) LTD

Bury Road, Radcliffe, Manchester, England

GENERAL
GENERAL ENGINEERING CO (RADCLIFFE) LTD

Telephone: Radcliffe 2291

Please send me details of the TA15 Continuous Coiler.

FIRM.....

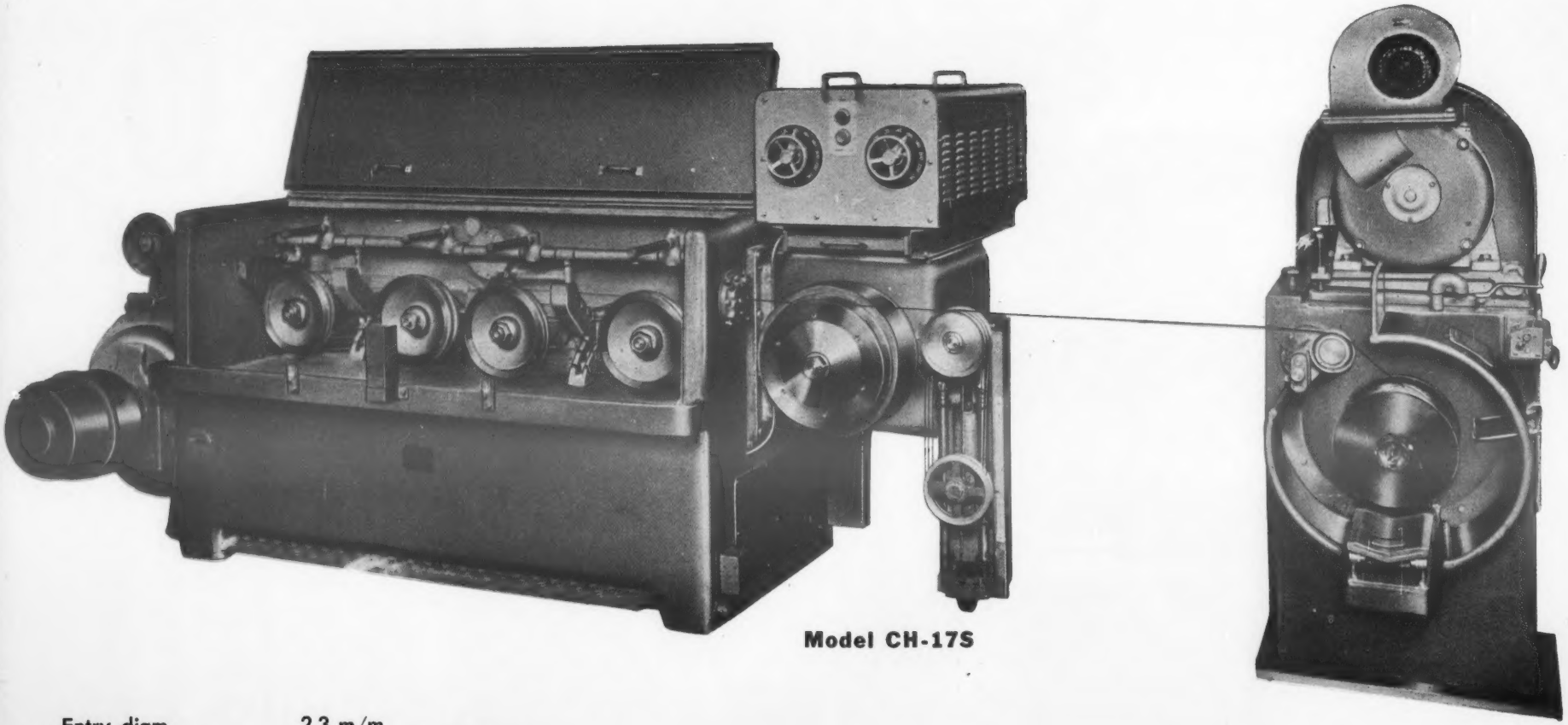
ADDRESS.....

NAME.....

W W P

WIRE DRAWING MACHINE
for coarse fine wire

SHOWA MACHINE WORKS LTD.



Model CH-17S

Entry diam.	2.3 m/m
Finished diam.	0.65 m/m to 0.32 m/m
Number of dies	17
Finishing speed	1300 m/min.
Power required	50 HP

SHOWA MACHINE WORKS LTD.
NO. 16, NAKA 3-CHOME, MITEZIMA, NISHI-YODOGAWA-KU, OSAKA, JAPAN

Direct burial telephone cable insulated with BAKELITE polyethylene is a step toward bringing nationwide direct dialing to the Glenwood Telephone Membership Corporation. Photo insert shows trench-cutting blade which pays out the cable while depositing the cable at depths up to 40 inches with minimum disturbance of road bed. Cable for project was manufactured by Whitney Blake Co., New Haven, Conn.

Polyethylene-insulated to make "Direct Burial" practical!

Out in Campbell and Upland Nebraska, they're making short work of bringing in dial service by using the new low-cost "direct burial" method of installation on all rural lines.

Not so long ago this method would have been impractical . . . but today, the outstanding performance of telephone cable insulated with BAKELITE polyethylene is making buried installations economically feasible, especially in rural areas and new housing developments.

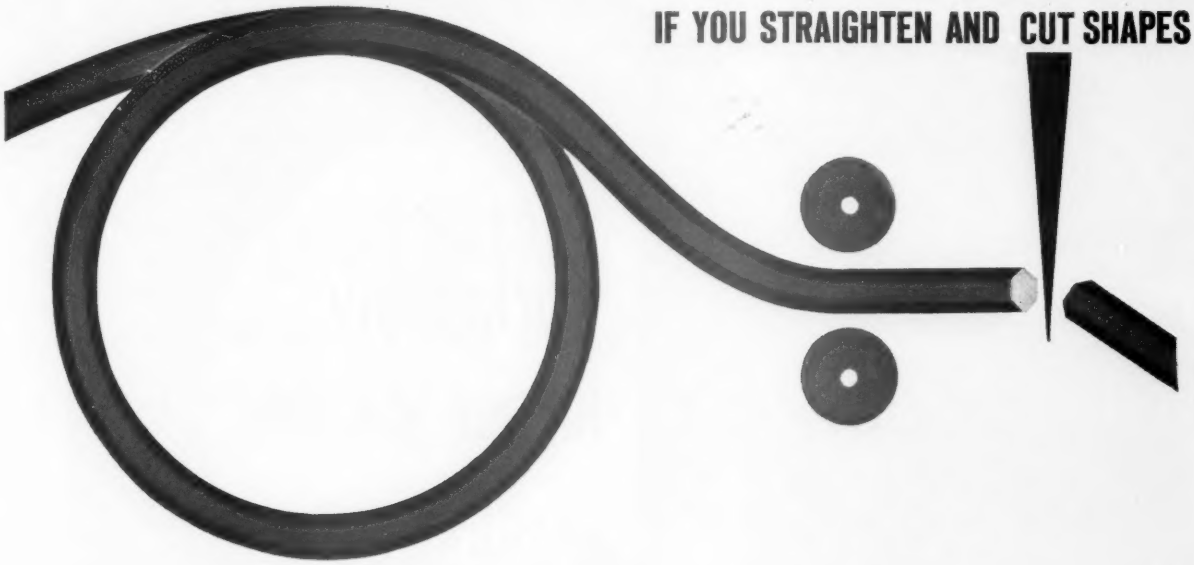
As insulation for these cables, BAKELITE polyethylene exhibits low-loss electrical characteristics over a wide frequency and temperature range, makes possible cable with lower capacitance unbalances, reducing crosstalk and noise level, permits permanent color coding for ease of installation and maintenance, and eliminates the time-consuming job of hermetically sealing each cable access point.

Above ground or below it, telephone cable insulated and jacketed with tough, lightweight BAKELITE polyethylene resists weathering, moisture, corrosives and rough handling during installation...assures long-term, reliable performance. For more information, write Dept. KC-160P, Union Carbide Plastics Company, Division of Union Carbide Corporation, 270 Park Ave., N.Y. 17, N.Y. *In Canada:* Union Carbide Canada Limited, Toronto 12.

UNION CARBIDE PLASTICS

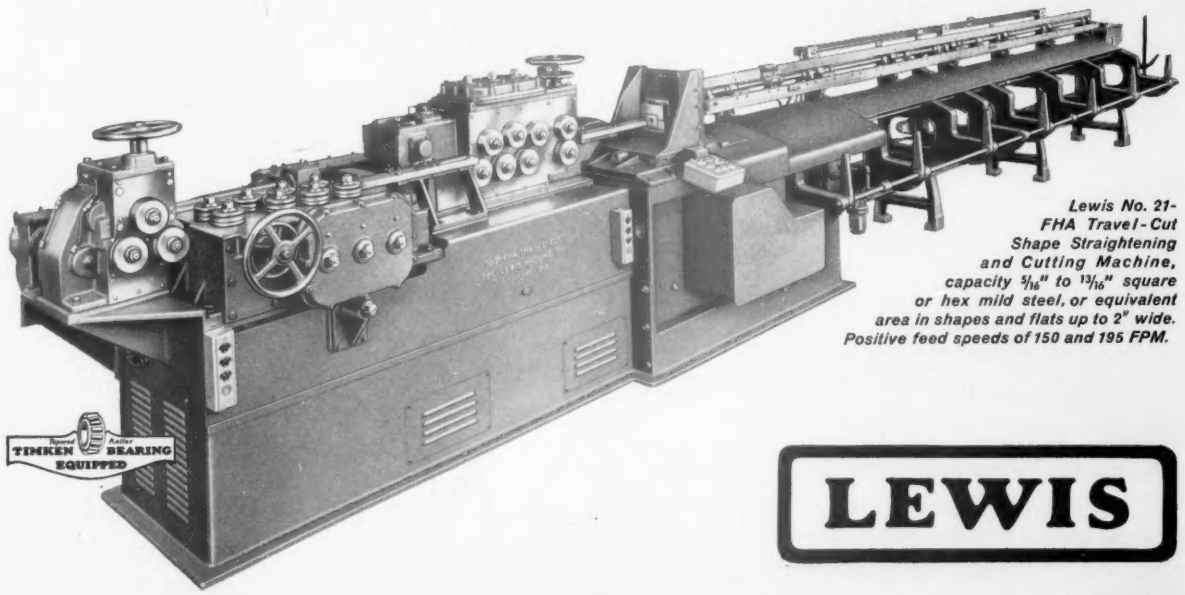
BAKELITE and UNION CARBIDE are registered trade marks of Union Carbide Corporation.

IF YOU STRAIGHTEN AND CUT SHAPES



You can have higher production on accurate predetermined lengths . . . direct from the coil because of these features: ■ Improved low-inertia flying-shear cutoff. ■ Simplified electric trip mechanism assures positive tripping of clutch at high speed. ■ Independent gauging mechanism permits greater accuracy and simplifies changing of cutting length. ■ All roll shafts power-driven and mounted on roller bearings. ■ Adjustable features in Horizontal Straightener Housing and Vertical Housing to compensate for various stock widths.

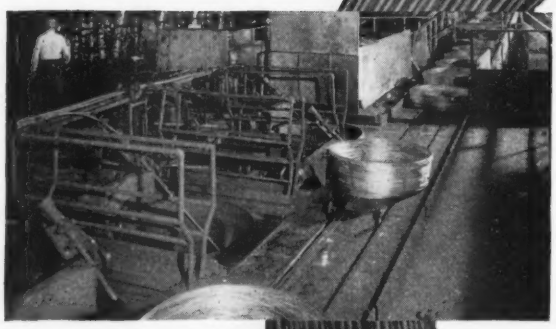
The Lewis Machine Company manufactures over 50 models of straightening and cutting machines to handle round wire from .012" to 1" diameter and from 1/16" to 13/16" square, hex and flat. Write or call us for information on your requirements.



Lewis No. 21-FHA Travel-Cut Shape Straightening and Cutting Machine, capacity 5/16" to 13/16" square or hex mild steel, or equivalent area in shapes and flats up to 2" wide. Positive feed speeds of 150 and 195 FPM.

LEWIS

LEWIS MACHINE COMPANY • A Division of the Curtis Manufacturing Co. • 3441 East 76th St., Cleveland 27, Ohio, MI 1-3015



workability,
longer die life,
production
efficiency

...You get these (and more) with NORTHWESTERN MANUFACTURERS' WIRE

This quality-through wire — made exclusively from electric furnace carbon steel — provides the two features you need most. (1) Excellence in the product you fabricate. (2) Production savings resulting from greater workability, longer die life, and fewer rejects.

Let us prove that we are a *dependable* source for standard or special purpose wire to meet your *exact* specifications. Call or write today for complete specifications.

Finishes Provided Galvanized • Pot Annealed • Bright • Extra Smooth Clean Bright • Annealed (Lime, Bright, Black)

ELECTRIC STEEL
Northwestern
STEEL AND WIRE COMPANY
SINCE 1879
STERLING, ILLINOIS
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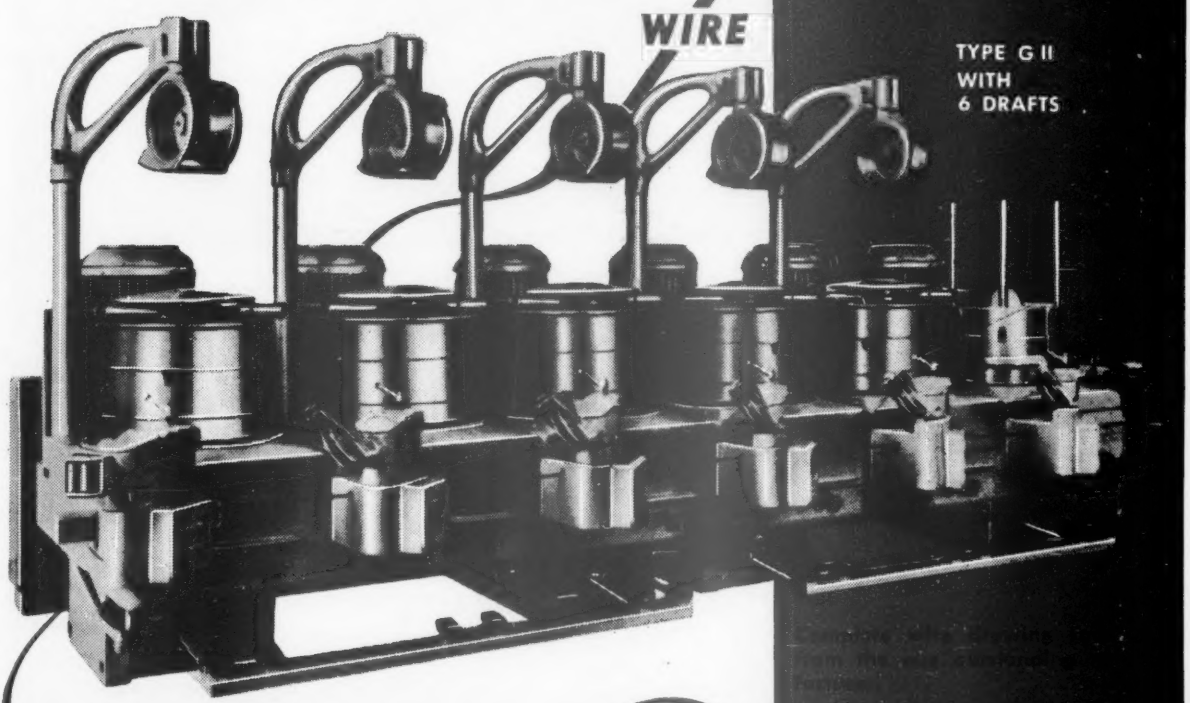
HERBORN

WIRE DRAWING MACHINES

NON-SLIP MULTIPLE OPERATION

FOR BASIC and CARBON STEEL WIRE



TYPE G II
WITH
6 DRAFTS

This is the Herborn Type G II non-slip multiple wire drawing machine with 5 drawing blocks 18" diameter and a finishing block of 20" or 24" diameter.

- *Each block has individual motor and drive with 2, 3 or 6 speeds.*
- *Water-cooled system, for blocks and die holders*
- *Precision ground helical teeth gears for smooth running.*
- *Smooth, slow-starting arrangement over a transformer.*
- *Emergency stop system, plus other safety features.*
- *The machine can be constructed as six separate, individual units which can be operated as single blocks, or in tandem as a 6 block unit.*

For complete information, write to:

HERBORN MACHINERY CORP.

335 HUDSON STREET, HACKENSACK, NEW JERSEY

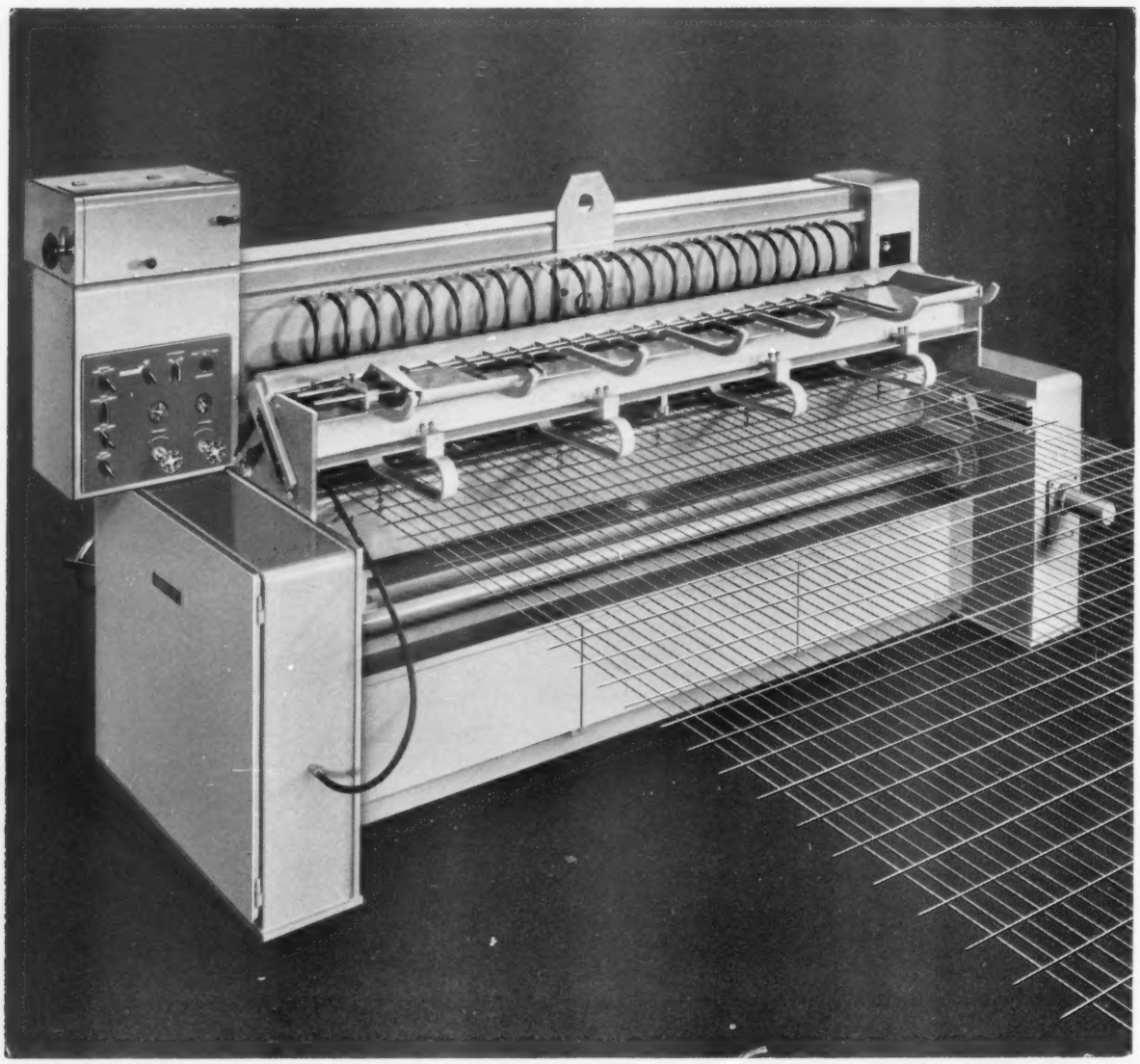
Maschinenfabrik Herborn - Berkenhoff & Drebes A.-G.

Herborn/Dillkreis (Germany)

SCHLATTER

We have been specialising in the construction of resistance welding machines for nearly half a century. Fifteen years ago we produced the first mesh welding plant. This long experience has been utilised in the development of our modern mesh welding plants, and our manufacturing programme now includes a comprehensive range of machines.

Model 1 for light mesh in rolls and sheets	Wire 0.06—0.16 inch dia., width 79 inch.
Model 2 for mild steel mesh in rolls	Wire 0.12—0.24 inch dia., width 104 inch.
for mild steel mesh in sheets	Wire 0.12—0.39 inch dia., width 104 inch.
Model 3 for mild steel mesh in rolls	Wire 0.12—0.24 inch dia., width 147 inch.
for mild steel mesh in sheets	Wire 0.12—0.39 inch dia., width 147 inch.
Model 4 for mild steel mesh in sheets	Wire 0.16—0.47 inch dia., width 147 inch.
Model 5 for heavy mild steel mesh in sheets	Wire 0.16—0.47 inch dia., width 104 inch.



H. A. SCHLATTER Ltd. ZOLLIKON-ZURICH (Switzerland)

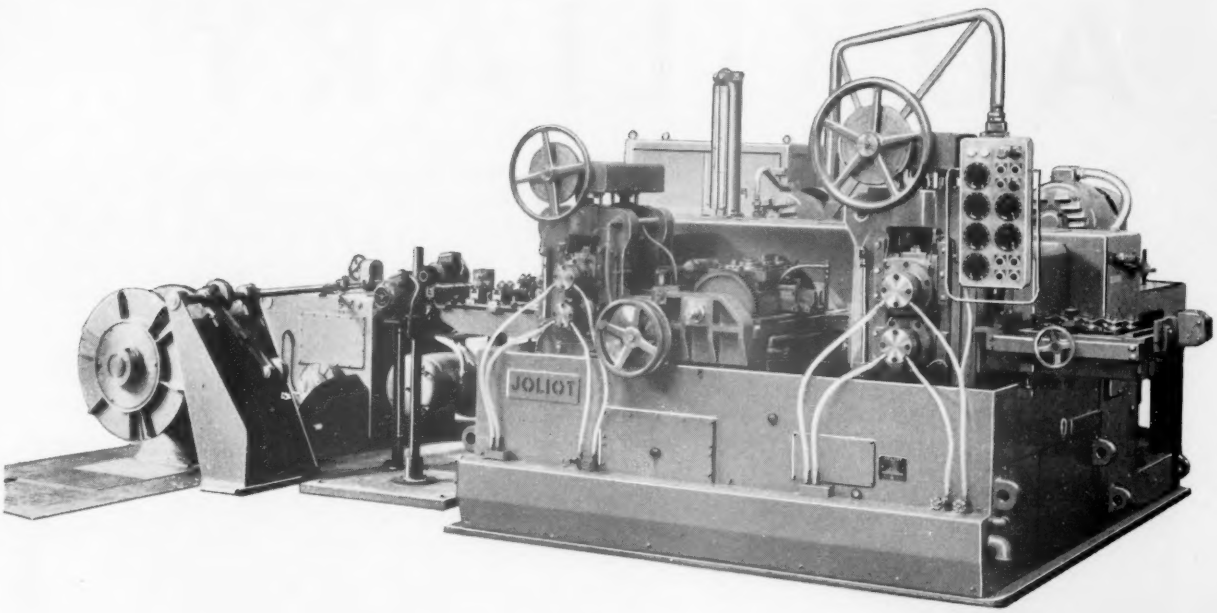
Manufacturers of Electric Welding Machines and Electronic Controls

Canadian Representative: Paul Reicher, Machinery and Equipment Ltd., 600 Eglinton Ave. East, Suite 307 - IBM Building, Toronto 12, Ontario

JOLIOT

WIRE FLATTENING-MILLS

to make strips of very high quality
Such as wanted by wire enamellers



Our rolling lines, each designed according to your very needs, will produce directly the most accurate shapes, rectangles, squares, with perfectly melt-in radii, at high speeds and low-price.

MAXIMUM ACCURACY : Large cast-steel stands - Solid rolls-Oil flow-bearings - Very efficient cooling - Continuous gauges.

MAXIMUM STURDINESS : Heavy welded steel body - Ground treated gears in oil-tight boxes - Drive through A. C. cage motors - No collector rings nor brushes - No frictions drive.

MAXIMUM VERSATILITY : You can control the speed of each pair of rolls and, separately, the torque applied. So no slipage can occur nor too high pull on the strip; dancer rolls are not necessary.

Perfectly wound coils : on constant-pull coiler, hydraulic traversing; weight: up to one ton.

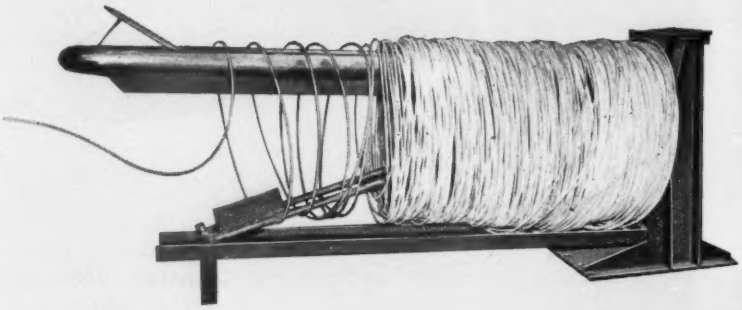
JOLIOT - 10, Rue aux Ours - PARIS-3e - (France)
Wire Drawing MACHINERY - Rolling Mills

Your enquiries will be welcome

production-wise
wire men choose

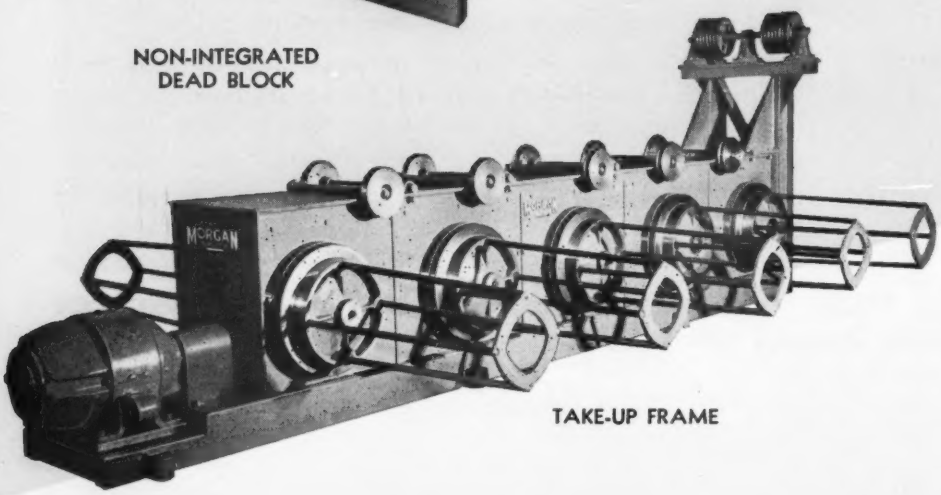
MORGAN AUXILIARY WIRE DRAWING

NON-INTEGRATED
DEAD BLOCK

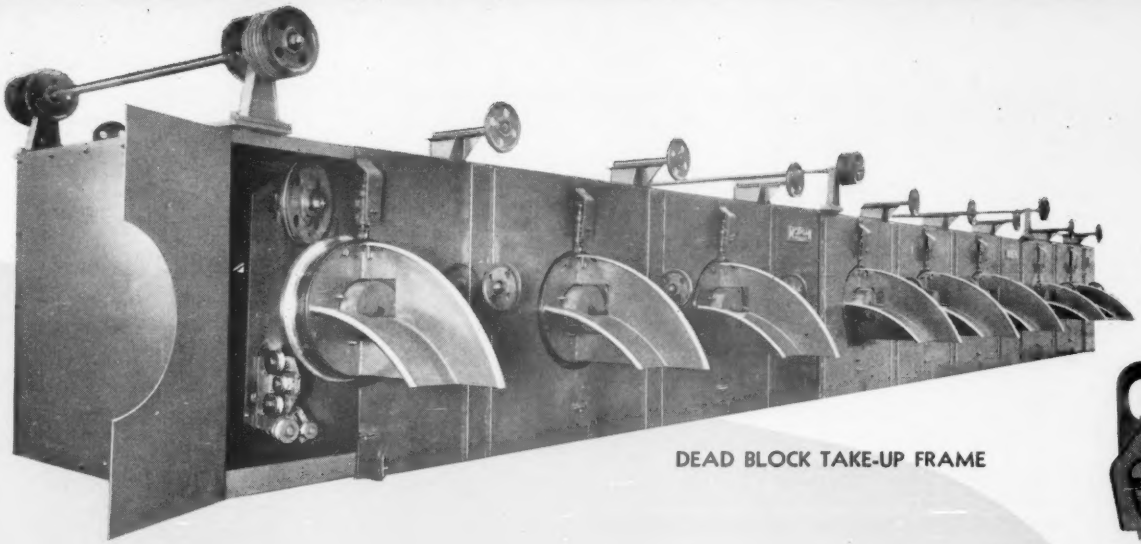


BOOM FLIPPER

MOTOR DRIVEN
POINTER



TAKE-UP FRAME



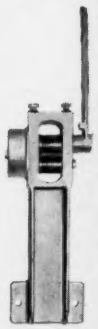
DEAD BLOCK TAKE-UP FRAME

GRIPS

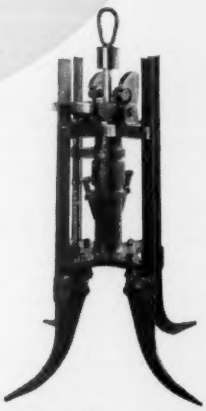
EQUIPMENT

You increase productivity with the MORGAN line of efficient, well-designed, auxiliary wire drawing equipment. Skilled wire machinery engineers have designed every piece of MORGAN Wire Drawing Equipment to give you maximum production efficiency.

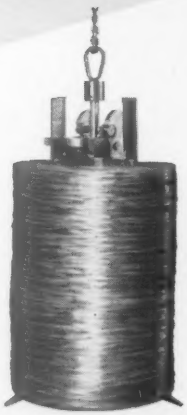
MOTOR DRIVEN POINTER

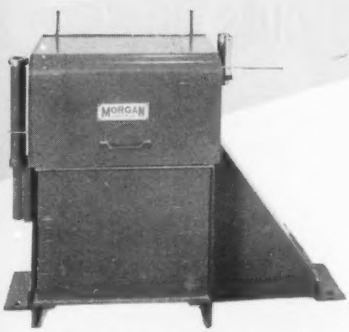


HAND POINTER

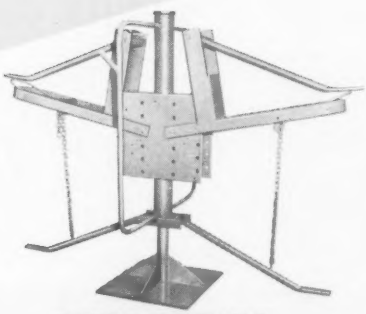


COLLAPSING RIDING STRIPPER





MECHANICAL DESCALER



DOUBLE TURNTABLE FLIPPER

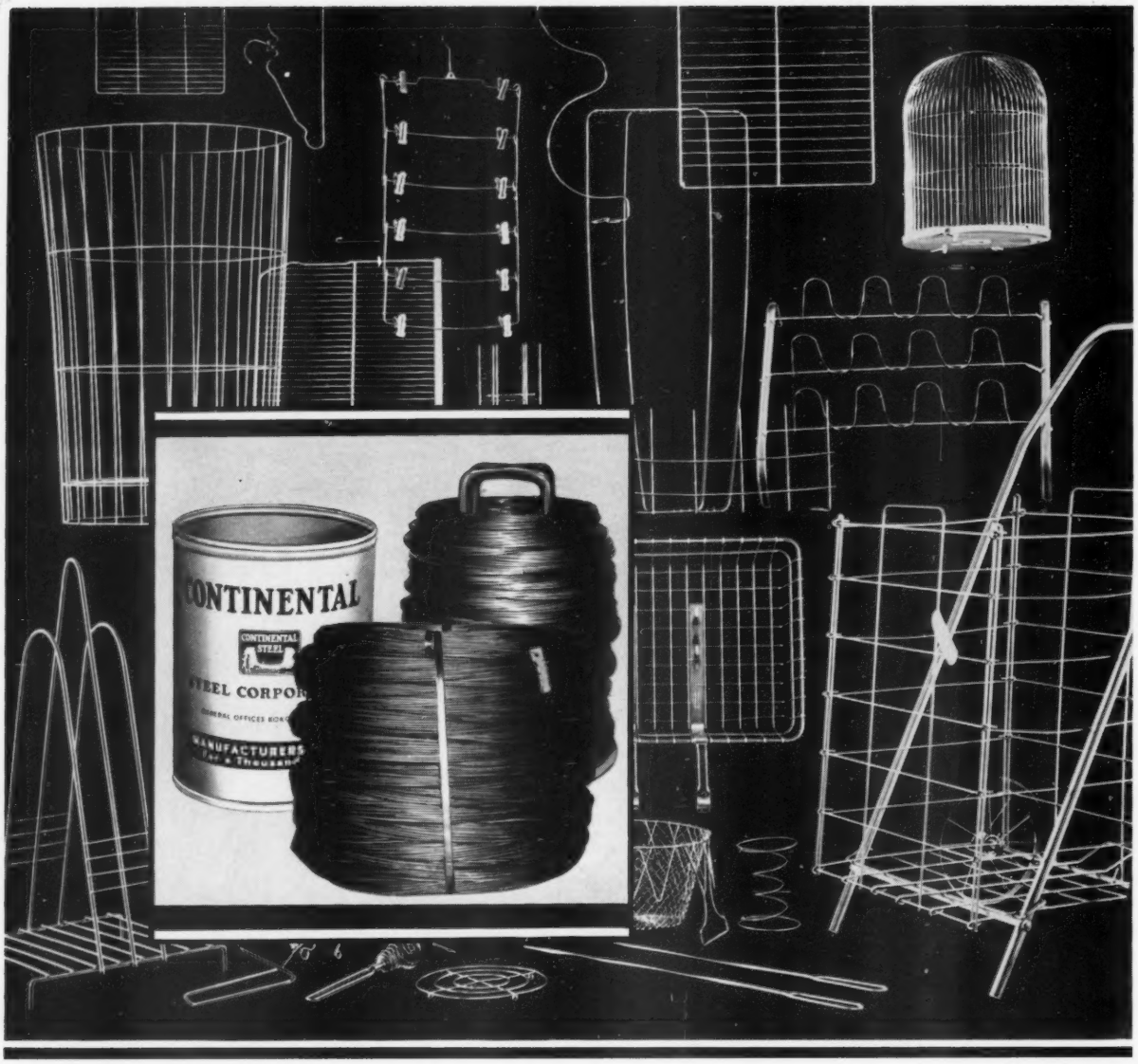
W11

MORGAN WORCESTER

MORGAN CONSTRUCTION CO.

WORCESTER, MASSACHUSETTS

ROLLING MILLS • MORGOIL BEARINGS • WIRE DRAWING MACHINES • COMBUSTION CONTROLS



how Continental® wire improves quality and cuts costs

Formability that permits difficult twists and bends . . . sustained fast production in coil after coil . . . smooth tight coatings that do not powder, flake or peel to jam machines. Such wire calls for consistent, uniform quality. You get it at Continental, in practically any size, finish, temper or analysis, in low, medium low, medium high and high carbon steels. Special shapes, too. In packaging, Continental was one of the first with long run, continuous length catchweight coils—Econo-Coil® with reel, Econo-Pak reel-less—1500# to 2500# depending on finish and gage. Or Leverpak, the modern drum container for 12 gage through 24 gage that keeps wire clean and dry. Why not let our mill technicians help you improve your quality and cut costs. We may have the answer to a particular need. Write today for your free copy of our new wire manual.

Steel

SPECIALISTS IN WIRE FOR OVER HALF A CENTURY

CONTINENTAL STEEL

CORPORATION • KOKOMO • INDIANA

PRODUCERS OF: Manufacturer's Wire in many sizes, tempers, and finishes, including Galvanized, KOKOTE®, BRYTITE®, FLAME SEALED®, Coppered, Tinned, Annealed, Liquor-Finished, Bright and special shaped wire. Also Welded Wire Reinforcing and Galvanized Fabric. Nails, Continental Chain Link Fence and other products.

NEW DEVELOPMENTS CONTINUE!

Large Continuous Electric Annealer VG 85 to be worked in combination with any copper rod break down machine, for bright annealed finished wire, for sizes between .14" and .048". Finishing Speeds up to 3000 to 4000 ft/min.

AMERICAN LAUBSCHER Corporation

FISK BLDG. 250 WEST 57th STREET
NEW YORK 19, N.Y.
EXCLUSIVE REPRESENTATIVES FOR U.S.A. AND CANADA

NIEHOFF

NIEHOFF MACHINE WORKS

SCHWABACH NEAR NURNBERG WESTERN GERMANY

Quality plus economy when you buy SUMITOMO steel wire rods

Rapid developments in the wire-product field have increased industry's demand for top-quality steel wire rods. Because of its international reputation for reliability, Sumitomo Metal supplies world markets — America in particular — with 7,000 tons of wire rods every month. To keep up with this export demand, Sumitomo Metal has added to its present facilities another new wire rod mill, completely equipped with the most modern machinery available.

Dimensions of Sumitomo Wire Rods

Diameter 5mm. (13/64") — 16mm. (5/8")

Weight Single Bundle
about 270 kgs. — 320 kgs.
600 lbs. — 700 lbs.
Compressed Bundle (6 coils)
about 1,620 kgs. — 1,920 kgs.
3,600 lbs. — 4,200 lbs.

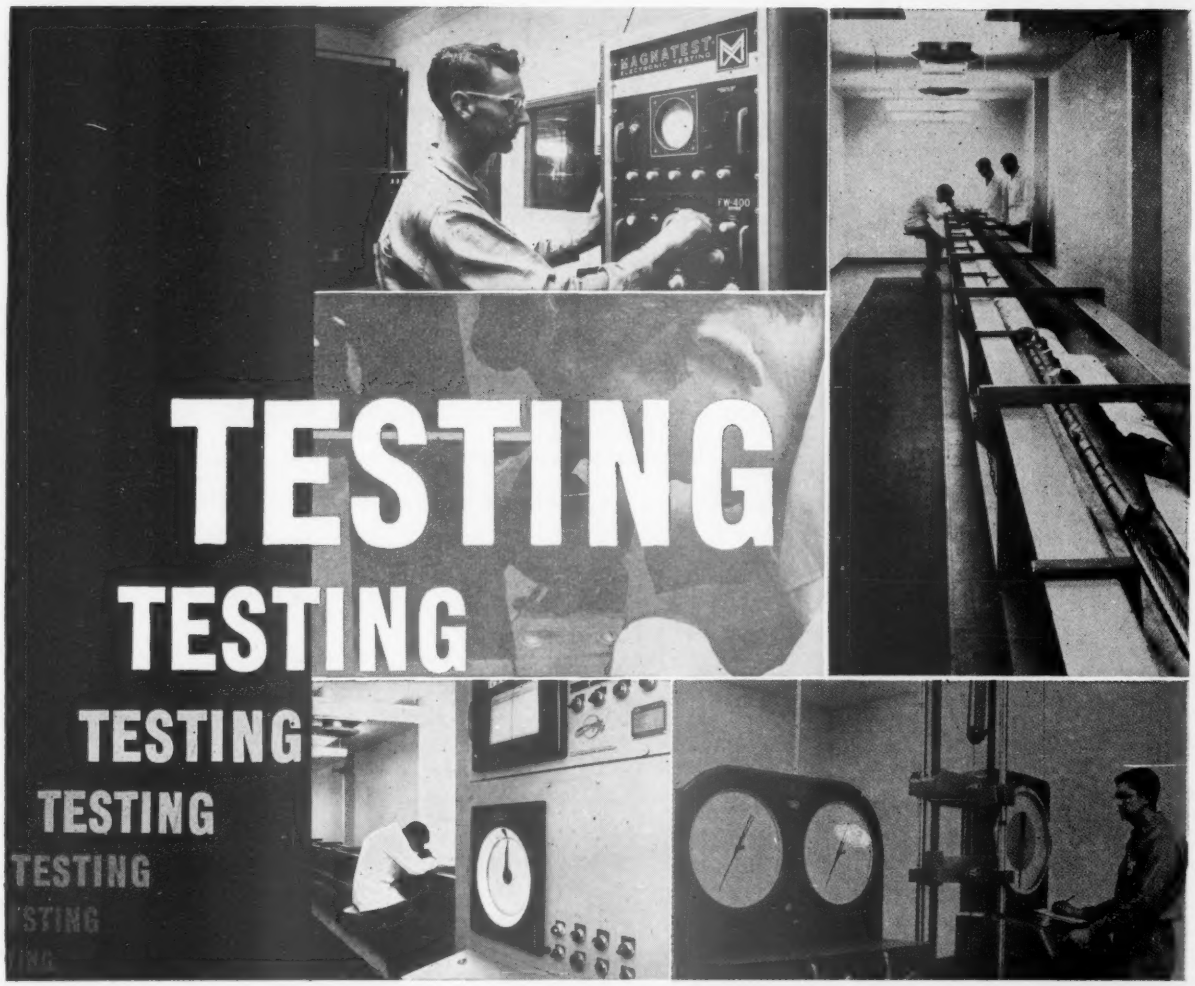
Coil Dimensions on Request

LEADING PRODUCERS OF STEEL WIRE RODS, PIPE AND ROLLING STOCK PARTS

SUMITOMO METAL INDUSTRIES, LTD.

Head Office: Osaka, Japan
Cable Address: "SUMITOMOMETAL OSAKA"

New York Office: 420 Lexington Ave., New York 17, N.Y.
Cable Address: "SUMITMETAL NEWYORK"



to match Southwire Quality with Southwire Service

Increasing transmission and distribution loads require exacting specifications and quality. To assure you of the utmost quality, Southwire conducts a battery of tests on all products . . . from raw materials to finished goods.

A complete, modern laboratory — staffed with quality-conscious technicians — enables us to conduct a diversified and technically thorough testing of all our products. As many as 14 separate checks are made on a given product!

Quality at every manufacturing stage assures you of predicable performance in Southwire products—manufactured to exacting industry standards or to your own particular specifications.

Quality is *automatic* when you specify Southwire — and Southwire Service is unmatched anywhere.

Representative Sampling of Tests Performed on Various Materials and Products

Spectroanalysis	Conductor Resistance	Insulation Resistance
Elongation	Oxygen and Air Aging	Flame Tests
Repeated Stress-Strain	Ultimate Strength	Moisture Absorption
Spark	Conductivity	Capacitance
	Dielectric	

Southwire Company

SOUTHWIRE serves the world

Carrollton, Georgia — TErrace 2-6311

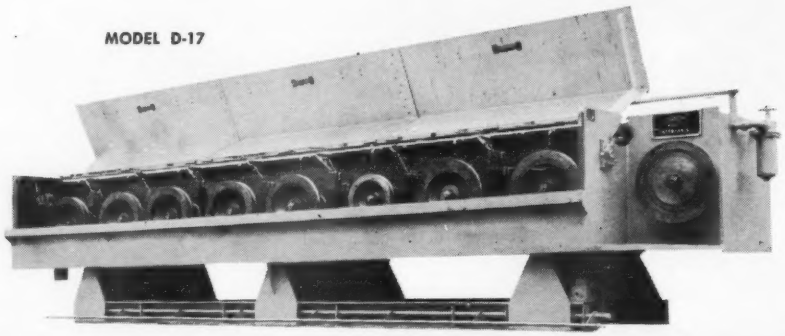
now, reduce 5/16" copper rod to #34 B&S gauge wire in only 2 steps

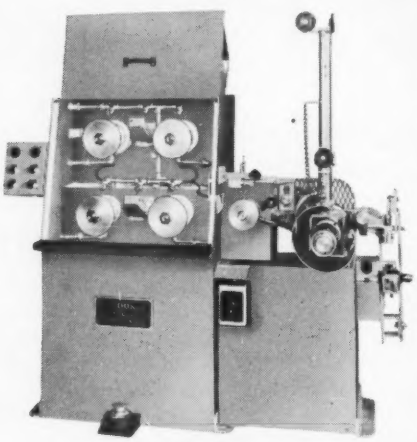
COOK

EQUIPMENT ELIMINATES 1 MACHINE LOWERS PRODUCTION COSTS

Now, with only 2 machines, in only 2 production steps, you can reduce 5/16" copper rod to #34 B&S gauge ANNEALED* wire. By eliminating one step, you save the cost of one machine and the cost of producing unnecessary intermediate wire sizes. And, with these Cook machines, you'll produce the highest quality wire at speeds up to 5,000 feet a minute.

MODEL D-17





MODEL F-31

Maximum Size of Entering Rod	5/16" Copper 3/8" Aluminum
Finished Wire Size	No. 8 to No. 19 B&S Gauge
Maximum Operating Speed	5000 F.P.M.
Maximum Number of Dies	17
Number of Drawing Blocks	8
Maximum Size of Die Case	1½" dia x 1" thick
Spool Capacity	1000 lbs.
Spool Traverse	11"
Spool Diameter	30"
Motor Size	150 HP

Maximum Wire Entering Size	#14 B&S Gauge
Finished Wire Size	#26 to #34 B&S Gauge
Operating Speed	5000 F.P.M.
Maximum Number of Dies	16
Number of Drawing Shafts	4
Size of Die Case	1" x ½" thick
Motor Size	15 HP
Spool Capacity	40 to 90 lbs.
Spool Flange Diameter	8" to 12"
Spool Traverse	6" to 8"

*** MODEL F-31 (above) available as a combination drawing and annealing machine**

COOK MANUFACTURING CO.

50 EAST 25th STREET, PATERSON, N. J. • ARmory 4-6380

DOMESTIC AGENT: THOMPSON ASSOCIATES, PALOS VERDES ESTATES, CALIF.

CANADIAN AGENT
E. V. LARSON CO., LTD., TORONTO, CANADA

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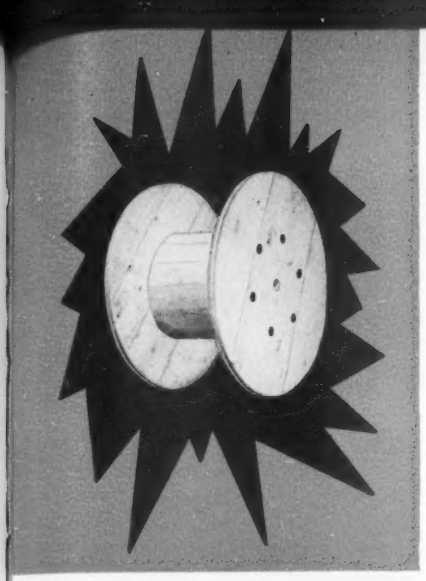
KNOERZER & CO., STUTTGART, GERMANY
CAPAMADJIAN LE MONNIER CIE LTD., PARIS, FRANCE



YOU SAVE WITH NON-RETURNABLES

BRIDGE REELS, through manufacturing techniques that have been continuously improved and streamlined, have become pre-eminently the standard for quality and dependability.

Look at these Advantages:

- Reduced Reel Investment
- Less Storage Space
- Lower Freight Costs
- No Return Freight Charges
- No Bookkeeping
- No Repair Costs
- No Deposits Needed
- No More Headaches! !

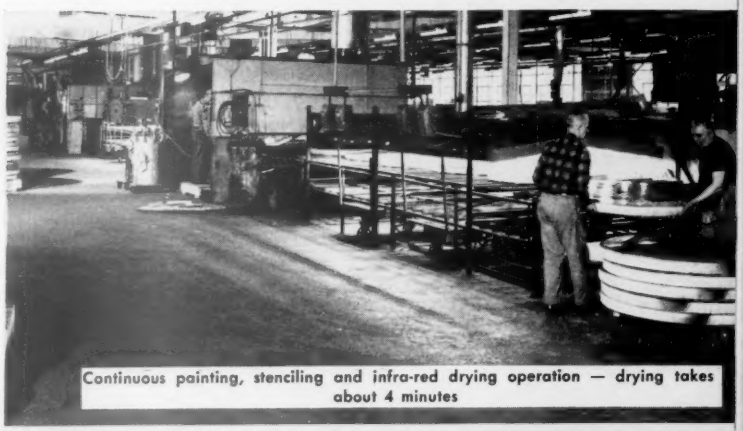
Start of production line for reel flanges.

Why BRIDGE REELS are Tops:

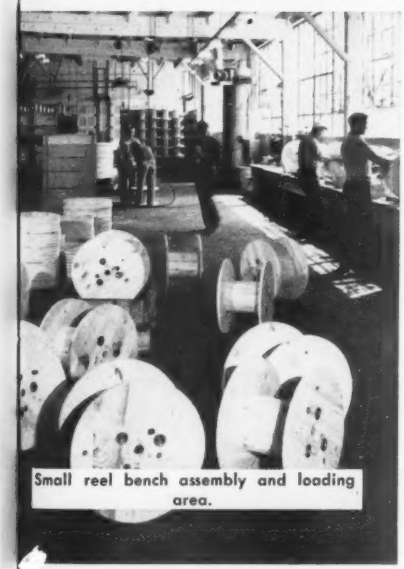
- Lumber Kiln Dried at Plant
- Latest and Finest Reel Manufacturing machines —many made to Bridge Special Specifications
- Fabricating methods continuously improved
- Fast, Efficient Straight-Line Flow of Production Work
- Painting and Stenciling Completed in approximately 4 Minutes
- Reel Assemblies made with many unique Mechanical Innovations
- Shipping and Delivery Facilities Unequaled

NON-RETURNABLE

WOOD REELS IN ALL SIZES FOR ALL TYPES OF ELECTRIC WIRE AND CABLE



Continuous painting, stenciling and infra-red drying operation — drying takes about 4 minutes



Small reel bench assembly and loading area.

NON-RETURNABLE REELS GIVE YOU A DEFINITE PACKAGING COST

Production line band sawing and multiple boring.

"REEL" GOOD —

Let us quote on your Reel needs. Send in your specifications. Better yet, visit our plant and see how Reels are made so well at so low a cost.

WOOD REELS

HIGH-SPEED SHIPPING SERVICE IN OUR OWN TRUCKS WITHIN A RADIUS OF 250 MILES OF THE PLANT, FAST FREIGHT WILL BRING YOU BRIDGE REELS WITHIN A FEW DAYS TO POINTS EAST OF THE MISSISSIPPI

TEL: THOMPSONVILLE, CONN.

VAUGHN® MOTOBLOX®

dependably draw

unique ALUMOWELD® *wire*

Heavy, pure aluminum, inseparably atomic-welded to a strong steel core—that's Alumoweld wire, used extensively today in the power and communications fields. And all of this valuable product is drawn rapidly, economically and dependably on VAUGHN Motoblox machines—whether destined for use as telephone line wire, overhead ground wire, core wire for ACSR conductors, guy and messenger strand or other essential and money-saving applications. • Whatever the wire, rod, bar or tube, there's a VAUGHN machine to draw it profitably. Write us!

The VAUGHN MACHINERY COMPANY

Cuyahoga Falls, Ohio, U.S.A.

COMPLETE COLD DRAWING EQUIPMENT . . . Continuous or Single Hole . . . for the Largest Bars and Tubes . . . for the Smallest Wire . . . Ferrous, Non-Ferrous Materials or their Alloys.

Who Buys Roebling Upholstery Spring Wire After You Do?

The end-user can hardly be expected to know a great deal about Roebling Springkote* Wire, helical spring wire, border and brace wire, zigzag and no-sag wire, wire for automatic machines, lacing wire . . .

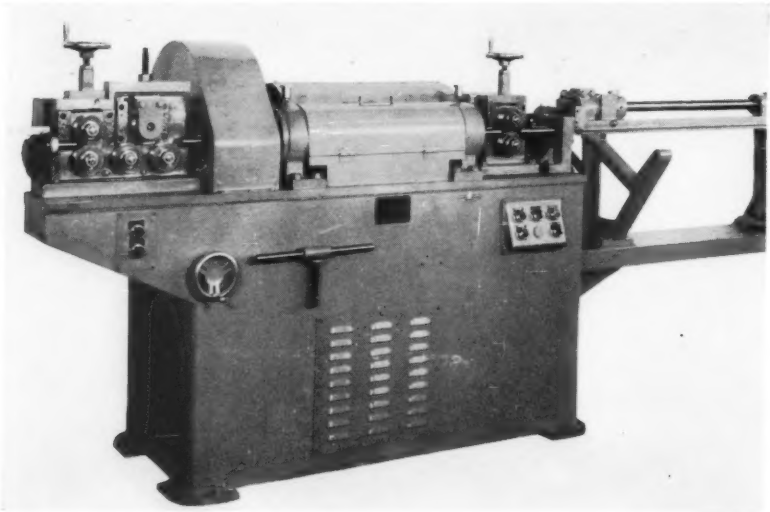
Thus, the qualities of uniformity, temper, tensile strength, size and finish that are yours whenever you use Roebling Spring Wire mean long life, resiliency under constant use (and abuse) where it counts the most . . . to those who buy Roebling Upholstery Spring after you do.

When *you* buy it, you have the advantage of getting these qualities in *large coils*—up to 3000 pounds for uninterrupted production. For further details, write Roebling's Wire & Cold Rolled Steel Products Division, Trenton 2, New Jersey. *Reg. applied for

ROEBLING

Branch Offices in Principal Cities
John A. Roebling's Sons Division
The Colorado Fuel and Iron Corporation

If you use wire up to 3/8", this new SHUSTER is just for you!



SINCE 1866

These new SHUSTER wire straightening and cutting machines incorporate new advantages to give you higher production—for less cost. The 2ABV variable speed unit straightens and cuts round wire from 5/32" to 3/8": the 2ABVF straightens and cuts shape stock up to 1/4" square.

The new machines include an improved, vertical drive 5-roll gear driven preliminary straightening unit, and feed roll housing. both Timken bearing equipped. The new SHUSTER'S can automatically cut lengths up to 14" at the rate of 140 pieces per minute, and provide infinite variable speed within all feed and cutoff ranges. This machine may also be purchased as a constant speed unit (150 f.p.m.).

Want more details? Send this coupon today!

Gentlemen:

☐ Please send me complete specifications and prices on the 2ABV-2ABVF SHUSTER.

☐ Send me specifications and prices to meet the following wire straightening requirements: .....

.....

Name .....

Address .....

City ..... *State* .....

SHUSTER FEATURES:

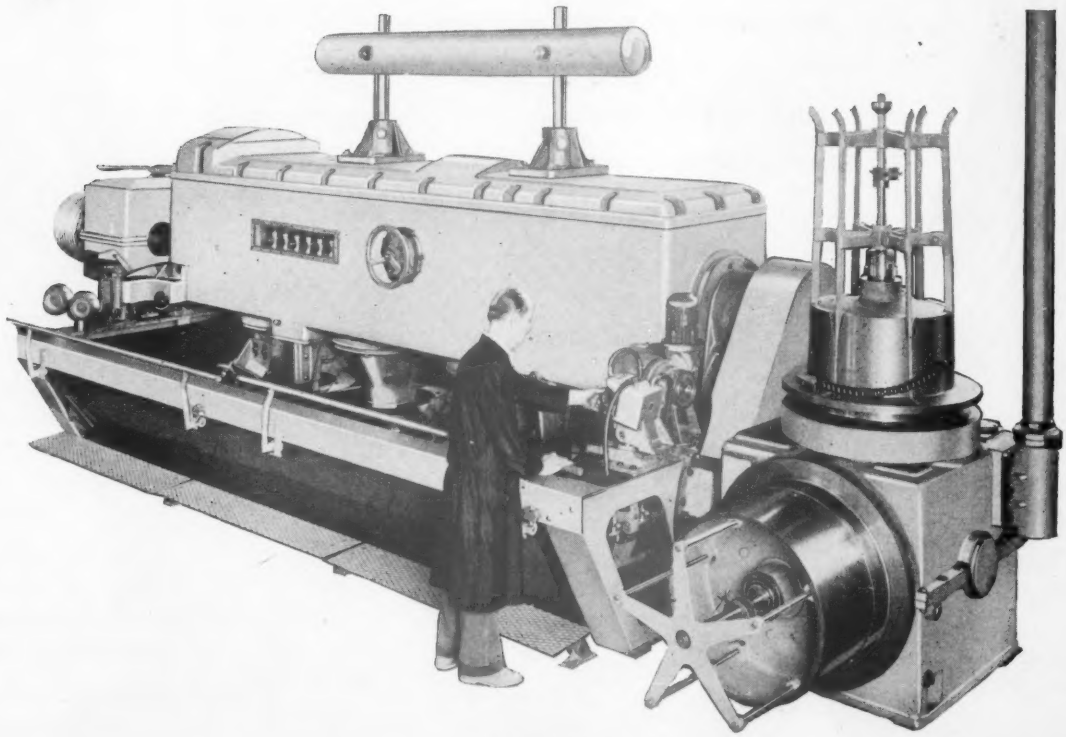
1. **Higher speed five die straightening arbor, mounted on ball bearings for minimum vibration.**
2. **Electric trip mechanism on target.**
3. **Solenoid-operated roll-type clutch.**
4. **Electric control Panels— two position operation.**
5. **Totally enclosed feed roll housing and prestraightener with shafts mounted on Timken Bearings. Gears in oil.**
6. **Electric Brake on clutch shaft.**
7. **Wide range Reeves Variable Speed. 50 to 200 F.P.M.**
8. **Wire size range: 5/32" to 3/8" diameter basic wire.**
9. **Gear driven preliminary 5 roll straightener, mounted in vertical position.**

METTLER MACHINE TOOL, INC.

155 W. Adeline Street ● New Haven, Connecticut

"SAMP"

Multiwire drawing machine – UNIVERSAL model MM-1/T
for drawing Trolley wires etc.



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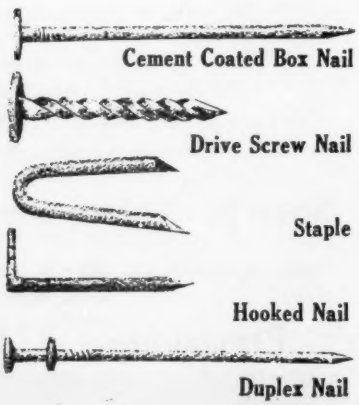
Meccanica di
Precisione

SAMP

Bologna
(Italy)
Via Galliera 12
telef. 235400
227400

QUALITY WIRE RODS AND WIRE PRODUCTS

Wire rods in all gauges, finishes, tempers and analyses, and wire products of every description, including all kinds of nail, regular and special, to your specifications . . . specify YAWATA to fill your needs.



YAWATA IRON & STEEL CO., LTD.

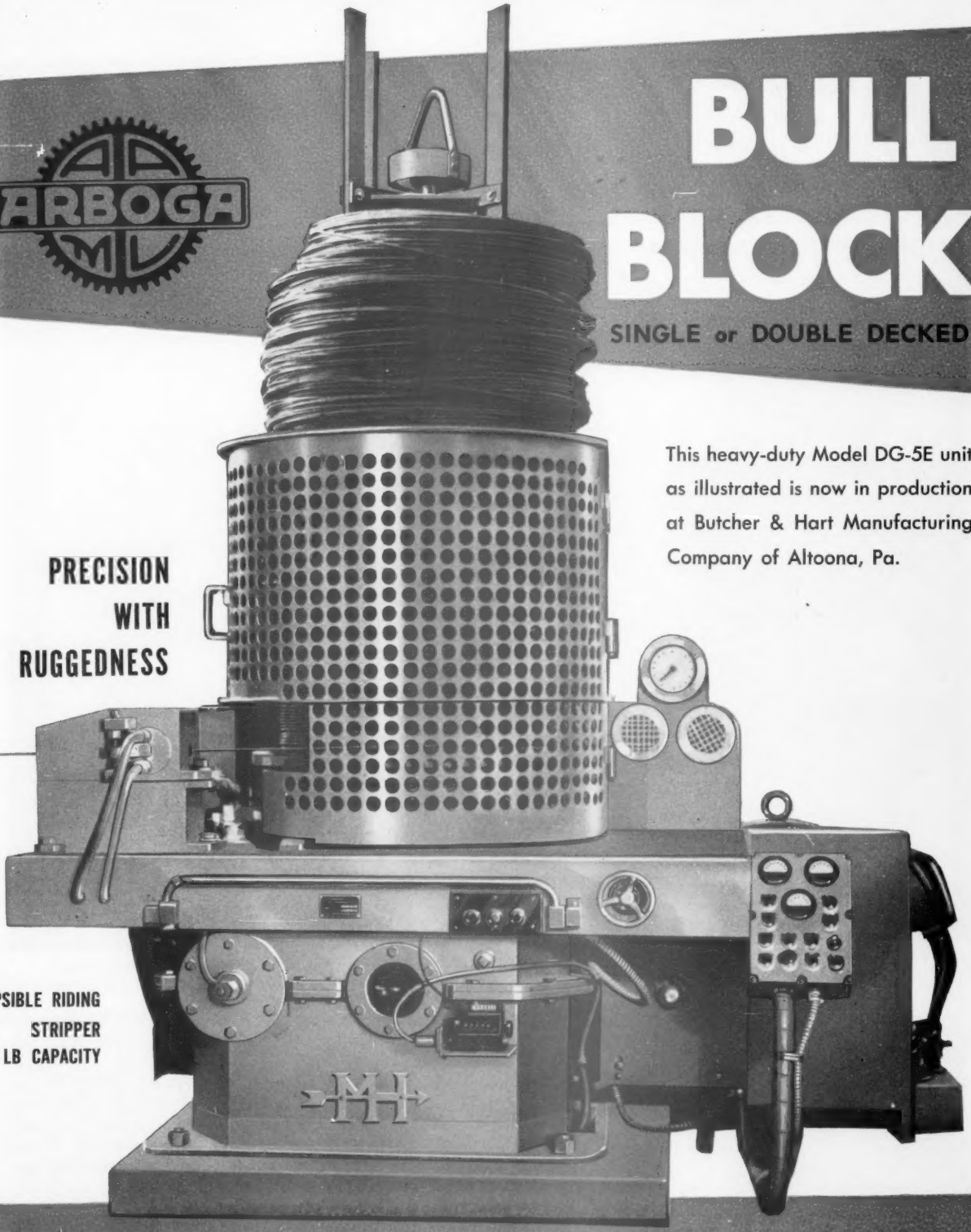
HEAD OFFICE: No. 1, 1-chome, Marunouchi, Chiyoda-ku, Tokyo, Japan
Cable Address: YAWATASTEEL TOKYO

EUROPEAN OFFICE: Immerman Strasse 15, Duesseldorf, West Germany
Tel: 1-0463 Cable Address: YAWATASTEEL DUESSELDORF

AMERICAN OFFICE: Rm. 2009, Seagram Bldg., 375 Park Ave., New York 22, N.Y., U.S.A.
Tel: Murray Hill 8-3327 Cable Address: YAWATAISCO NEWYORK

BULL BLOCKS

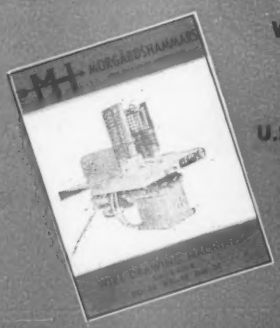
SINGLE or DOUBLE DECKED



This heavy-duty Model DG-5E unit as illustrated is now in production at Butcher & Hart Manufacturing Company of Altoona, Pa.

PRECISION WITH RUGGEDNESS

COLLAPSIBLE RIDING STRIPPER
3000 LB CAPACITY



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U.S. OFFICE MH. MACHINES
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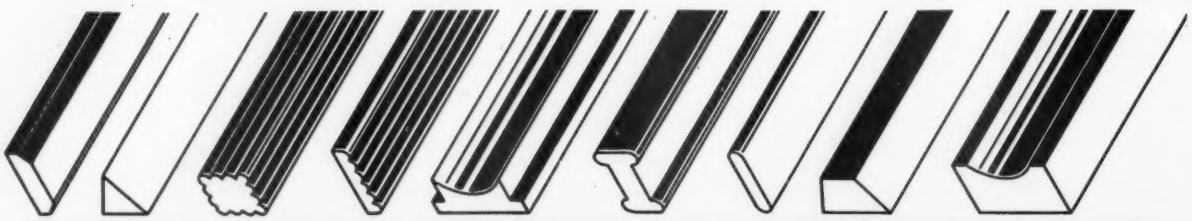
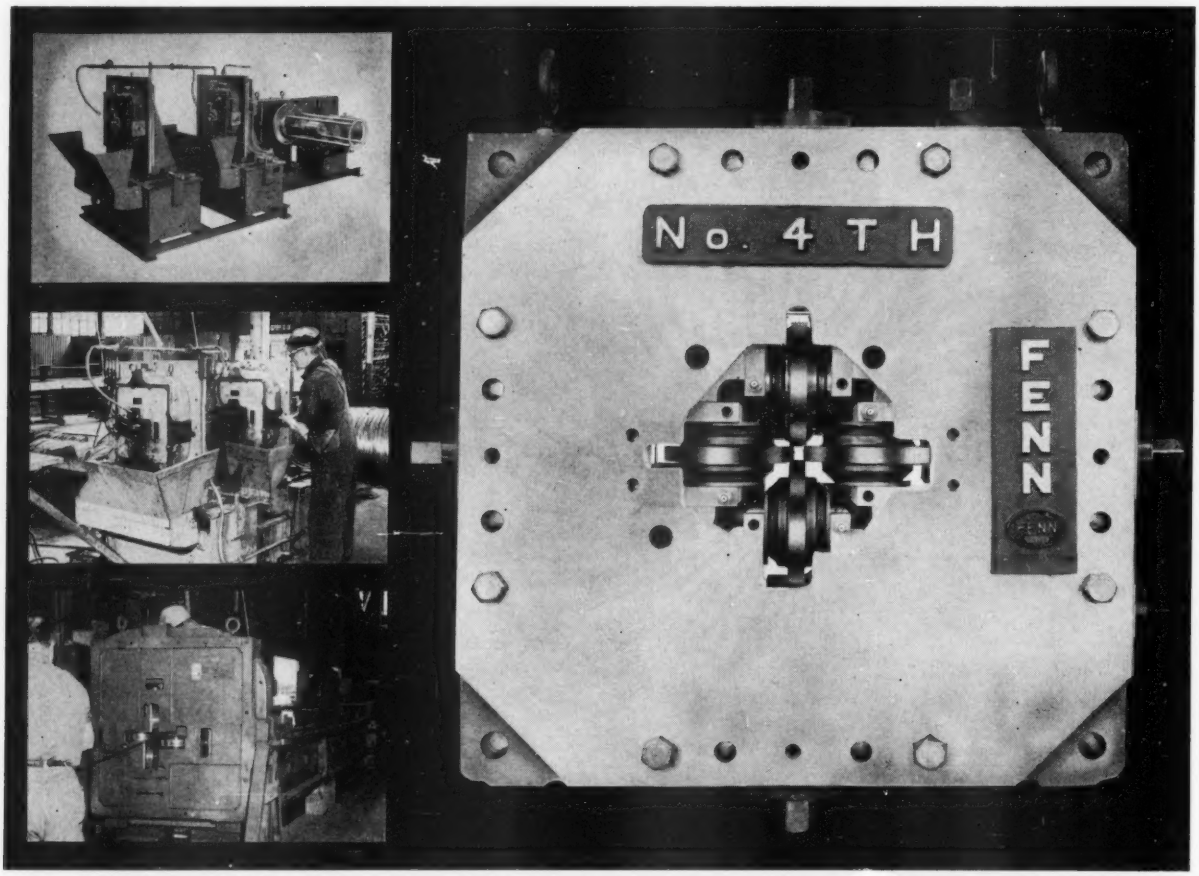
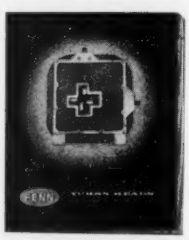




Top and Center — *Wire Shaping Mills with tandem Turks Heads.* Bottom — *Turks Head with Draw Bench.* Right — *Fenn Combination Type Turks Head.*

Wire Shaping with FENN Turks Heads

Fenn has pioneered the development of the Turks Head to their present day wide usage for precision production wire shaping. Used on the Wire Shaping Mill (developed by Fenn), on draw benches, or in tandem with Rolling Mills, Fenn Turks Heads produce many precision shapes, both plain and special, such as shown above, with both ferrous and nonferrous wire and rod. They aid in size control, and impart a fine surface finish. Fenn manufactures a complete line in plain, universal, combination and triangular types with bearing capacities at 100 RPM up to 56,400 pounds for heavy reductions. Fenn also makes the important accessories, such as capstans and take-up reels. If it's a wire-shaping problem or requirement, chances are Fenn can help you. Fenn's central engineering department and field engineers are ready to assist you. A copy of the Turks Heads Catalog No. TH56 will be promptly sent upon request.

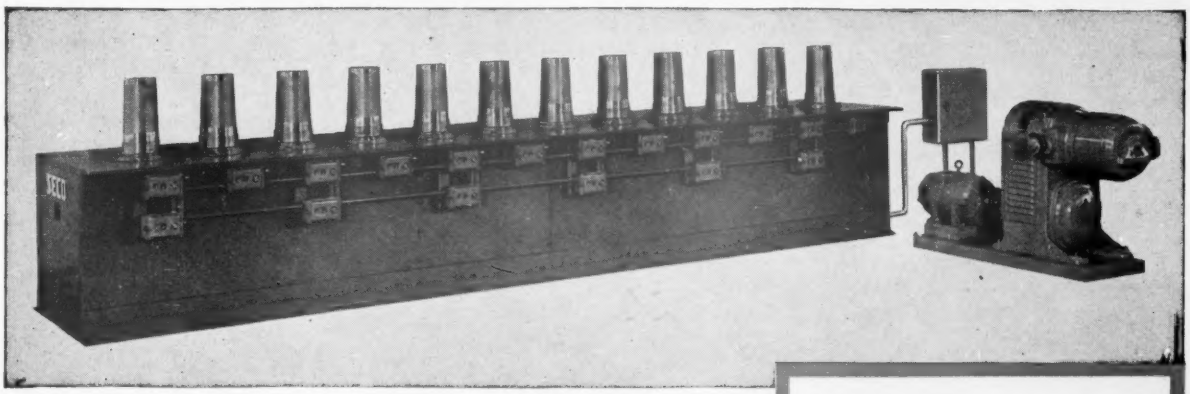


The Fenn Manufacturing Company, Newington, Conn.

SECO

Fine wire TAKE-UP FRAMES

The "last-word" in wire-winding efficiency!



- **Simplified Design and Construction**
- **Synchronized Electrical Variable Speed**
- **Noiseless, Vibrationless Running**
- **Greatly Increased Operating Capacity**

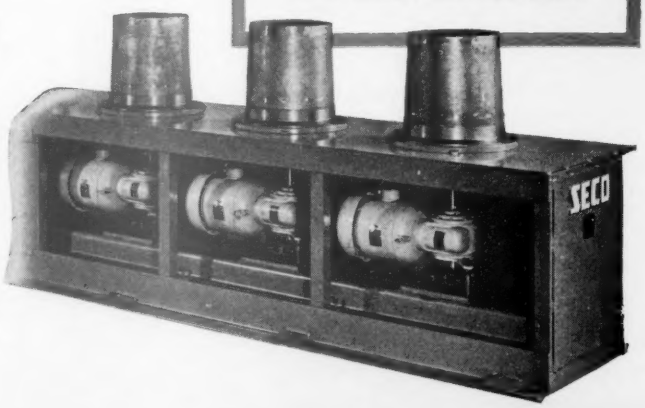
SHOWN ABOVE:
SECO Take-Up Frame and VARIDYNE Electrical Power Unit which provides synchronized variable speed to the multiple drives. AC current is employed throughout, and the VARIDYNE System "gears" all the drives together by electrical impulses.

SHOWN BELOW:
The AC squirrel-cage induction type gear motors which drive the spindle blocks through hollow bored shafts.

SECO builds take-up frames for handling fine gauge steel or non-ferrous wire on 8", 12", or 16" diameter blocks...with linear wire speeds up to 1,000 FPM or higher. Superior features include a multiple electrical drive system (alternating current) for synchronized electrical transmission of variable speed power.

This gives simultaneous speed changes to all spindle blocks, in ratios up to 5:1 or even 10:1 or higher. It provides push-button stop-start control to each of the gear motors driving each spindle block. Gone is the old bevel gearing, with manually operated clutches for starting and stopping the blocks.

SECO high production take-up frames are constructed to accommodate any number of spindles required. Frames with horizontal spindles can also be built. Call or write for complete information and data. Consultation invited—no obligation.



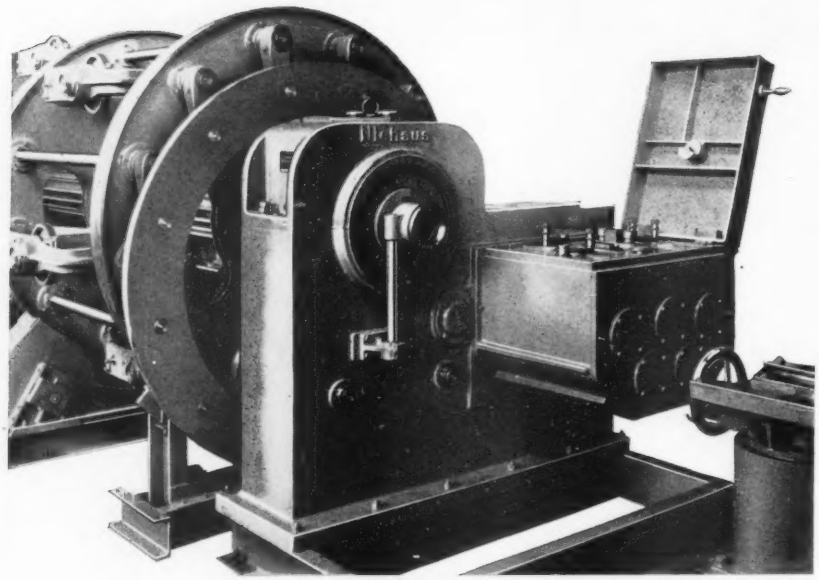
STEEL EQUIPMENT COMPANY
P. O. BOX 737, WARRENSVILLE STATION
CLEVELAND 22, OHIO

SECO

NIEHAUS

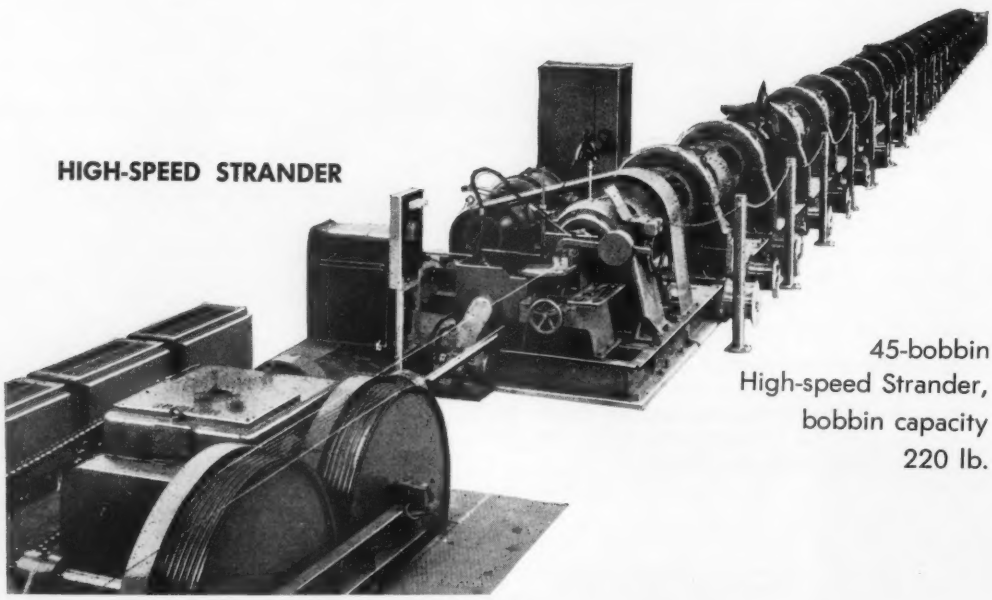
ELECTRIC-CABLE MACHINERY • WIRE-ROPE MACHINERY

PLANETARY STRANDER



We manufacture: Stranding and Rope-closing Machines of tubular and planetary design, of any size and for any number of bobbins, as well as the pertinent auxiliary machinery and equipment.

HIGH-SPEED STRANDER



45-bobbin High-speed Strander, bobbin capacity 220 lb.

MASCHINENFABRIK K. A. NIEHAUS • DUSSELDORF-RATH

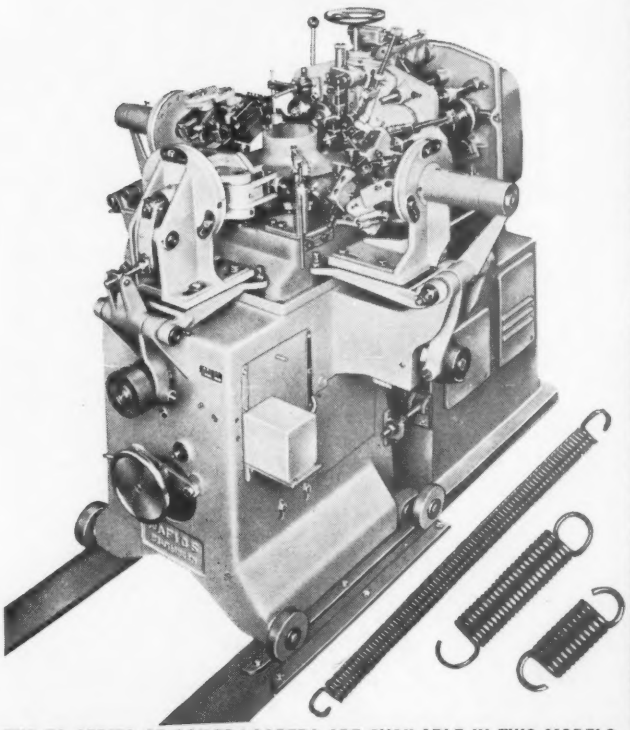
Sole Representative: Paul Reicher Machinery & Equipment, Ltd., 600 Eglinton Ave., East, Toronto 12, Ont., Canada

Thinking Of Purchasing A Spring Coiling Machine?

HERE IT IS! THE FIRST FULLY AUTOMATIC UNIVERSAL

SPRING COILING AND LOOPING MACHINE

BY... **WAFIOS**



THE ZO SERIES OF COILER-LOOPERS ARE AVAILABLE IN TWO MODELS:

	Model ZO/15	Model ZO/30
Wire diameters	.0197" to .054"	.0394" to .118"
Lengths of Springs	.750" to 5½"	1¾" to 7"
O.D. of Springs	.200" to ⅝"	.394" to 1"

TWO MACHINES IN ONE! TWO SIMULTANEOUS OPERATIONS MEAN LESS LABOR AND PRODUCTION COST

Can Be Pulled Apart and Used Separately.

Here is a truly economical machine with plenty of versatility. Designed for the production of extension springs looped on both ends, this machine can make loops parallel or at any angle to each other.

With the Model ZO, you can produce springs with normal loops, half open loops or machine loops and also, springs having two different types of loops.

The uniformity of placements of loops and lengths of springs far surpasses results achieved by "old fashioned" methods.

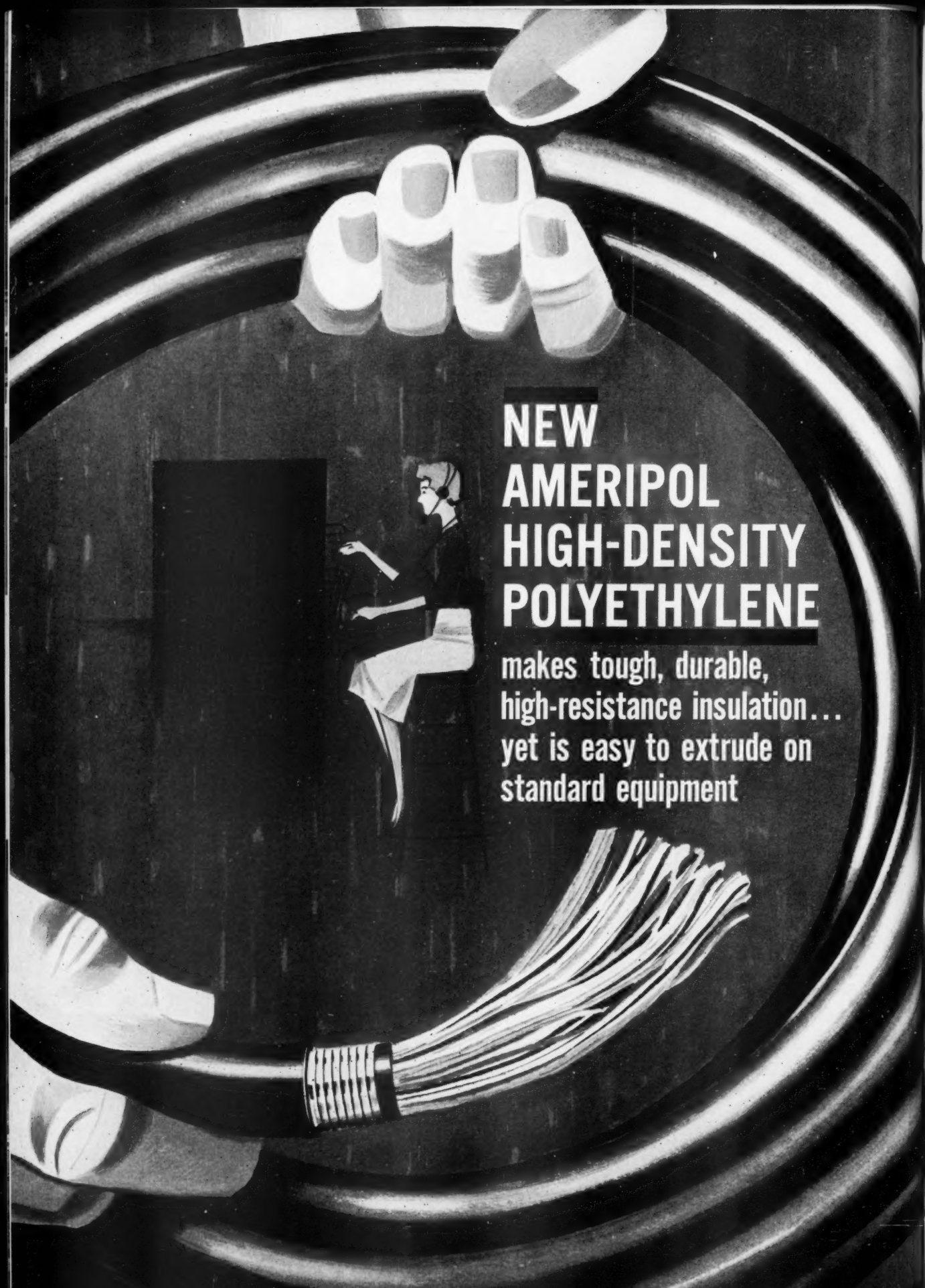
PRODUCTION ON BOTH MODELS UP TO 48 COMPLETE SPRINGS PER MINUTE.

In addition to the above machines, Wafios manufactures a complete line of spring coiling machines including: Universal and Segment coilers, torsion coilers, hand loopers, spring grinders, etc.

WAFIOS MASCHINENFABRIK Wagner, Ficker & Schmid
REUTLINGEN/WURTT., GERMANY

WAFIOS
MACHINERY CORP.
335 HUDSON STREET, HACKENSACK, N. J.

WAFIOS MAKES THEM ALL -- The World's Most Complete Line


NEW
AMERIPOL
HIGH-DENSITY
POLYETHYLENE
makes tough, durable,
high-resistance insulation...
yet is easy to extrude on
standard equipment

Ameripol polyethylene for wire and cable. Ameripol polyethylene is a **new** ethylene plastic polymer that combines durability and processability.

The Goodrich-Gulf process imparts new highs in the important properties of environmental stress cracking resistance (SCR) and thermal embrittlement resistance, while maintaining the processing ease of conventional high-density polyethylenes.

This material makes an exceptionally tough, cut-resistant, abrasion-resistant coating for wire and cable. The insulation has excellent dielectric properties and resistance to elevated temperatures.

Ameripol can be extruded on standard equipment at commercial production rates. Thus high-density polyethylene is now practical for wire and cable fabrications.

Write for Ameripol Data File—contains complete information on properties, specifications, application to wire and cable.

PROPERTY	UNITS	ASTM METHOD	AMERIPOL 34	AMERIPOL 35
Dielectric Strength @25°C (a)	volt/mil	D149-59	1100	1100
Dielectric Constant @25°C...		D150-59T		
60 cps.....			2.16	2.16
1,000 cps.....			2.19	2.19
10,000 cps.....			2.26	2.26
100,000 cps.....			2.31	2.31
1.0 mc.....			2.38	2.38
Dissipation Factor @25°C....		D150-59T		
60 cps.....			0.0002	0.0002
1,000 cps.....			0.0002	0.0002
10,000 cps.....			0.0002	0.0002
100,000 cps.....			0.0003	0.0003
1.0 mc.....			0.0003	0.0003
Volume Resistivity.....	ohm-cm	D257-58	7×10^{15}	7×10^{15}
Insulation Resistance (b)....	megohms/ 1000 ft.	D257-58	167,000	265,000
Low Temperature Wire Wrap (c).....		D1351-54T	Passed	Passed

(a) #14 wire with a total wire and wall thickness of 0.128 inches, immersed in tap water 1 hr. @ room temperature before testing.
(b) Tested on #20 wire with a 64-mil wire and wall thickness for 1 year at 75°C.
(c) #20 insulated wire wrapped 8 times on a 0.313" mandrel at −70°F.

CHECK THESE SUPERIOR ELECTRICAL PROPERTIES

Goodrich-Gulf Chemicals, Inc.

1717 East Ninth Street • Cleveland 14, Ohio

THE ONE TO WATCH FOR NEW DEVELOPMENTS

WE'LL DESIGN A SPOOL TO FIT *Your* NEEDS

1 3" Magnet Wire Plastic Shipping Spool

2 6" Magnet Wire Plastic Shipping Spool

3 Heavy Duty Wire Drawing and Processing Reel

4 Weld Wire Spool

5 Standard 8" x 6" x 3" Aluminum Processing and Shipping Spool

6 Aluminum Tapered Barrel Processing and Shipping Spool

7 Standard Wood-Metal Shipping Reel

HUBBARD Engineers are Designing and Developing New Methods of Packaging Both Ferrous and Non-Ferrous Wire. Most recent addition to our Long List of Products is a Line of Improved Flangeless Packaging Equipment, Prototypes of which have been successfully operated under severe winding conditions.

HUBBARD Spools and Reels can be supplied in any size from 2½" to 72" in Diameter in a wide range of materials – WOOD, PLASTICS, STEEL, ALUMINUM, PAPER OR COMBINATIONS THEREOF.

HUBBARD has an accumulated half-century of experience and is equipped with the tools and "knowhow" for the most versatile wire packaging problems. We invite your inquiry.

Special Engineering Service

HUBBARD SPOOL DIVISION

VN *Van Norman Industries Inc.*

West Coast Representative:
THOMPSON ASSOCIATES
Box 1143, Palos Verdes Estates, Calif. Phone: FRontier 7-4042

TELEPHONE FL 7-5141

GARRETT, INDIANA

The Wire Outlook

Recent developments in international affairs have altered the economic outlook markedly. A great impetus to production that will come from Government spending for preparedness for possible eventualities makes it look now as though we now are headed for a boom period of unprecedented proportions.

The economy was tending in that direction in any event, but the rate of progress has been speeded up. Inventories no longer were being reduced, prices are beginning to rise, and a new wave of accumulation of stocks is becoming evident.

Granted that the Berlin and other Communist-made crises necessitate a greater degree of spending for arms for the defense of our foreign commitments, it is a sad commentary on the lack of common sense among legislators and the Administration that efforts are not being made to curtail welfare and other bureaucratic spending all along the line.

As an example, farmers are still held in thralldom by price supports and regulations, as emphasized by the Cadillac incident, in which a farmer drove to Washington in the car he had bought with money received for not raising corn. The sequel was that he was fined this year for raising more than his quota. Rome is burning while the bureaucrats fiddle! Farm price supports cost us $2.5 billion a year.

The cost of living is expected to rise about 2 percent in the coming year. Next year it is expected that more autos, a higher rate of building, more appliances and hard goods will be made and sold, personal incomes will tend to be higher, and profits already are improving in most quarters.

With all this, especially considering the estimated $7 billion national deficit in 1962, the trend is bound to be inflationary, for which the future is bound to pay. If taxes are increased, as seems inevitable, there will be less and less for the consumer to spend for goods and services, gradually making the public increasingly dependent upon government spending just to have jobs. This is one of the sad effects of having a man at the helm who has had no experience with the need for considering the cost of anything.

One of the things that well could have widespread adverse effects in business circles is the present plan to curtail tax deductions for business entertainment. In spite of flagrant abuses that do exist, entertainment is part of the American way of doing business, yet every bureau has big entertainment budgets. The Department of State alone has provision for nearly a million dollars for this purpose, yet many of its minions complain that they do not have enough and must dig into personal resources for entertainment on some occasions. This is one of the inconsistencies of government thinking.

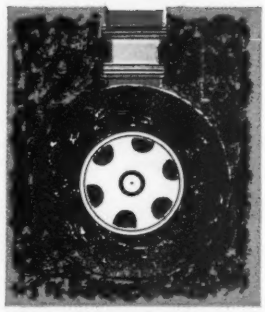
Insulated wire manufacturers have had a better Summer than anticipated. Sales and new orders are reported to be strong. Many brass and copper wire mills are experiencing improved business. Manufacturers' wire, following several months of upward trend, slackened in July, with some pickup in August. The outlook beyond August is for continuing improvement. Spring wire and wire for concrete reinforcement also is giving evidence of strength.

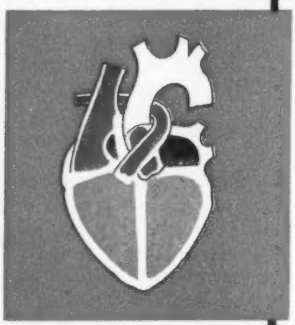
With the gross national product (GNP) in the second quarter at a rate of around $515 billion, $10 billion above the previous high and $15 billion over the first quarter, the rate for the third and fourth quarters should greatly exceed early-year estimates.

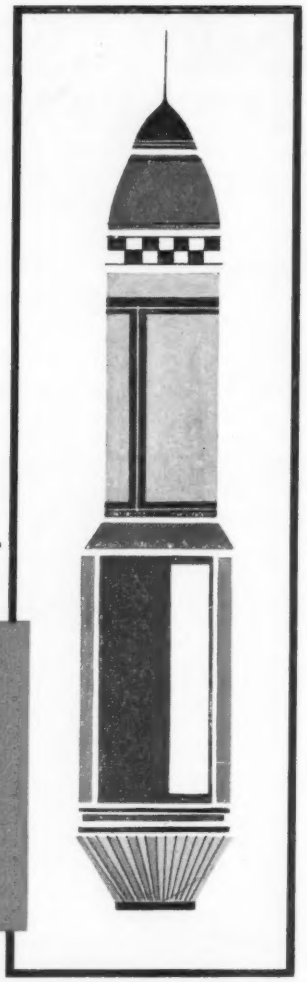
Although the figures for unemployment continue at high levels, business men, barring the belligerent talk of freedom's enemies involving us in a major conflict, should prepare for a long period of accelerating activity.

Edmund D. Nichols
EDITOR

NS NATIONAL-STANDARD COMPANY ON THE PRODUCT...







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The Logarithmic Function of Equi-Reductions in Multiple Drawing Operations

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Anton F. Mohrheim

After World War II he went to Canada, where he was appointed Research Fellow and Assistant Project Director of the American Electroplaters' Society in 1952. He came to the United States in 1954 and worked for three years with Leach & Garner Company in Attleboro, joining the University's technical staff in 1957. He became a citizen of this country in 1959.

Abstract

The close relationship between equi-drawing of wire and well known physical phenomena in natural sciences is shown. This precept is the basis for a logical system of simple equations leading to a practical method for quickly solving tedious wire drawing problems. By understanding the phenomena involved and applying the Log Log slide rule, which is now used in all engineering colleges, a greater versatility in processing is possible and no special gadgets for wire drawing calculations are necessary. The method is shown and explained in illustrative examples for the processing of steel, aluminum, and titanium wire.

Introduction

Multiple drawing by equi-reductions is widely used in modern industry for the manufacturing and processing of wire and tube. This mode of operating implies that each drawing die in a series reduces the cross sectional area of the metal by a constant percentage and involves also a constant reduction in area between heat treating (annealing) stages. The cross sectional area of the metal, before each drawing and at each previous annealing stage, respectively, is considered each time as a unit on which the percentage reduction is based. This method replaces costly trial and error methods and requires that the processing engineer computes the series of bore diameters of the drawing dies (see Fig. 1), the series of diameters of the annealed wire,[1] the series of circumferential speeds of the capstans (drawing drums), and sometimes the force and power requirements for single and multiple drawing processes.[2]

To find the solutions to these problems seems to be tedious, if the "per cent reduction in area," the traditional measure of plastic deformation, is used as a term. However, these problems can elegantly and quickly be solved if the "elongation factor" is used as the basic term instead,[3] and if the physical nature of the phenomena involved is clearly understood.

The Physical Phenomena of Equi-Reductions in Multiple Drawing

To the writer's knowledge, it never has been stated explicitly that the equi-reduction method can be expressed in formulas anal-

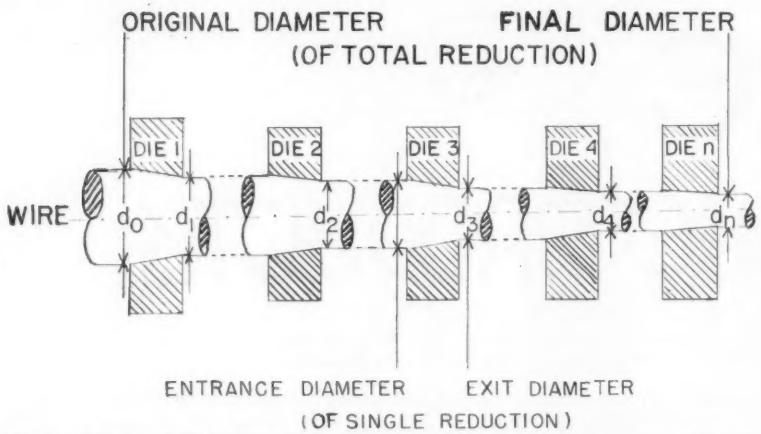

Fig. 1 — Diagram showing schematically the multiple drawing of wire from the original diameter, d_o, to the final diameter, d_n, through a series of 5 (n) drawing dies.

ogous to those which are well known in natural sciences for many physical phenomena, such as, for example, the absorption of light, the dissipation of sound, and the decay of voltages, currents and radio active matter.

These phenomena, and many others, have in common that the original unit (intensity of light and sound, voltage, amperage, and radiation count, respectively) diminish in geometric progression at a constant rate, that is, the change in one variable is proportional to the logarithm of the ratio of the other variables:

$$\log y_2/y_1 = \text{const X } (x_2 - x_1) \qquad \text{Eq. 1}$$

Any mutation of x_1 to x_2 by the interval i entails a change of y_1 to y_2. When the ratio y_2/y_1 is given the notation r, that is, the "rest" of the original whole quantity, the equation above can be suitably arranged to permit the solution of problems by using the "proportion principle" for Log Log scales of the slide rule:

$$\frac{\log r}{i} = \text{const} = \frac{\log r_1}{i_1} = \frac{\log r_2}{i_2} = \ldots \qquad \text{Eq. 2}$$

Similar to the phenomena above, in multiple drawing by equi-reductions, the original cross sectional area, a_o, of the metal is reduced to a smaller area, a_n, for intervals, $x_2 - x_1$ (drawing passes or annealing stages), by a constant percentage, const. The logarithm of the ratio of the areas, a_n/a_o, is equal to the product of the const. and the interval, (Cf. Eq. 1):

$$\log a_n/a_o = \text{const X } (x_n - x_o) \qquad \text{Eq. 3}$$

The ratio of the areas, a_n/a_o, may again be called rest or remainder but, since the notation R is generally used for the per cent reduction in area, the writer prefers here to name it "left-over," L, which is most practically expressed as a decimal fraction of the whole quantity (original cross sectional area).

In accordance with equation 2 and the fact that only integers (whole numbers) can be chosen as intervals, the following general formula for equi-reduction processing may be written:

$$\frac{\log L}{n} = \text{const} = \frac{\log L_1}{1} = \frac{\log L_2}{2} = \ldots \qquad \text{Eq. 4}$$

Basically, equation 4 is applicable to the "proportion principle" of the slide rule having Log Log scales. However, for practical reasons which will be explained later, the logarithm of the "reciprocal of L," 1/L, is used instead of the logarithm of L. (In arithmetic this may be called the colagarithm of L). The reciprocal of L has a very definite, physical and practical meaning; it is the "elongation factor" which expresses how many times the original length is elongated by drawing.

The Elongation Factor's Practical Relationships

In practice, one is mainly concerned with units which can be measured directly, such as the length of the wire (feet), the drawing speed (feet of wire per minute), and the diameter (inches) of the wire. The cross sectional area itself, in most cases, is of no interest but has to be calculated when the term "per cent reduction in area" is used. However, if the "elongation factor" is used instead, as has been suggested and explained by the writer,[3] the relationship between length, speed, diameter, slippage, and "mean flow factor" is simultaneously shown with one setting of the slide rule and all wire drawing problems can be solved without intermediate calculations of the areas involved. The fundamental relationship is expressed in the following proportion which shows that the elongation factor, E, is equal to the ratio of the wire length after n drawing passes to the original length before drawing, l/l; E is also equal to: the ratio of the wire speed after n drawing dies to the speed of the original wire, s_n/s_o; the inverted ratio of the corresponding cross sectional areas a_o/a_n; and the square of the ratio of the original (entrance) diameter to the final (exit) diameter, $(d_o/d_n)^2$:

$$\frac{E}{l} = \frac{l_n}{l_o} = \frac{s_n}{s_o} = \frac{a_o}{a_n} = \left(\frac{d_o}{d_n}\right)^2 \qquad \text{Eq. 5}$$

The elongation factor is, of course, always larger than 1. If the ratio of the diameters is set on the D and C scales of the slide rule, the ratio of the lengths, speeds and areas is set simultaneously and automatically on the A and B scales of the slide rule and vice versa. E is read opposite the index of the B scale, on A scale. (L also can be read opposite the index of A scale, on B scale). Therefore, when the given values are set, the unknown values can be read directly on the appropriate scale of the slide rule ("proportion principle"). Fig. 2 shows diagrammatically the relationship of the main drawing variables on the slide rule.

The Total and Single Elongation Factors

In multiple drawing operations "equi-reductions" are synonymous with "equi-elongations," that is, with each step of reduction the wire is elongated by the same factor, the elongation factor.

The "total elongation factor," E,

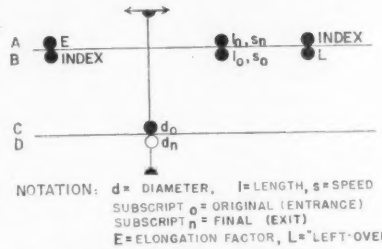

Fig. 2 — Schematic diagram showing the A, B, C, and D scales of the slide rule, the initial setting of the diameters and the resulting positions of wire drawing variables.

after n drawing steps is given by the square of the ratio of the original and final diameter, $(d_o/d_n)^2$; the "single elongation factor," e, is given by the square of the ratio of the entrance and exit diameter, $(d_o/d_1)^2$, of each individual step (Cf. Fig. 1). Both factors are found separately by using the proportion principle of the slide rule suggested in Fig. 2.

The total elongation factor is equal to the product of all (n) single elongation factors. Since in equi-elongations e is constant, this leads to the operation of multiplying the elongation factor by itself n times, where n is a positive integer (whole number) or e^n, the nth power of the single elongation factor (basis value or proportion factor), e:

$$E = e^n; \text{ or inversely written:}$$
$$\log E = n \log e \qquad \text{Eq. 6}$$

The Practical Log Proportion For Equi-Elongations

Using the logarithmic form of equation 6, log E = n log e, and by rearranging, the following proportion is found which is suitable for the direct reading of results on the slide rule having the Log Log scales:

$$\frac{\log E}{n} = \frac{\log e}{1} \qquad \text{Eq. 7}$$

Comparing this equation with equation 4, one sees their similarity; instead of L (which, of course, is always smaller than one, involving a slightly inconvenient negative mantissa) the elongation factor is used which, of course, is always larger than one, yielding a positive mantissa.

When two variables of the proportion (Eq. 7) are given, the unknown third variable is found by one slide rule setting as schematically shown in Fig. 3.

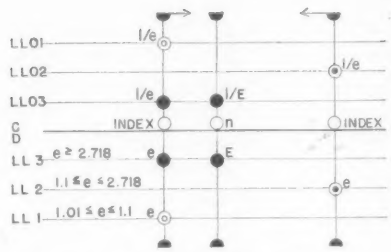

Fig. 3 — The log proportion principle for equi-elongations. The horizontal lines represent the scales of the slide rule, the vertical lines the positions of the hairline depending on the value of the single elongation factor.

Conversion of the Elongation Factor into Reduction in Area

As explained before, by using the elongation factor as the basic term in calculations for wire processing, the cross sectional areas of the wire and the per cent reduction in area are not needed. If, however, the conversion of the elongation factor into the per cent reduction in area is desired, one may take advantage of the fact that each slide rule setting for the elongation factor shows simultaneously its reciprocal, 1/E, which is equal to the "left-over," L:

$$L = 1/E \qquad \text{Eq. 8}$$

Using the A, B, C, and D scales of the slide rule, (Cf. Fig. 2),

set index of B opposite E on A, read opposite index of A, L on B.

The per cent reduction in area, R, by definition is then:

$$R = (1-L)100 \qquad \text{Eq. 9}$$

To find the "left-over," L, two other slide rule methods are also possible and may in some cases be very convenient:

1. **Using the C or D scales with CI or DI (reciprocal) scales, respectively. The basic relation of these scales is: When the hairline is set to E on the C or D scale, the reciprocal (or inverse), 1/E = L, is set at the hairline on the CI or DI scale, respectively. The red numbers associated with the reciprocal scales enable the operator to recognize these scales.**
2. **Using the "mated" Log Log scales of the slide rule. ("Mated" scales are pairs of Log Log scales having the same number in their labels, and each of a pair is called the "mate" of the other.) The mated paris are: (LL3 — LLO3), (LL2 — LLO2), and (LL1 — LLO1). The basic relation between mated scales is: "Opposite numbers on mated scales are reciprocals of each other." In finding reciprocals by means of mated Log Log scales there is no question as to the position of the decimal point. This method has a high degree of accuracy and has the advantage that the decimal point is shown at its correct place. To find the "leftover," L = 1/E, (Cf. Fig. 3), push hairline to E on LL3 or LL2 (depending on its value), at hairline read 1/E on LLO3 or LLO2, respectively.**

The following examples show the application of the elongation factor and the proportion principle for Log Log scales for practical wire drawing and processing. The reader is advised to keep his slide rule before him while reading the examples, and should make all settings indicated in the illustrated examples. The principles are easily understood but a certain amount of practice is required to enable wire drawing personnel to use the suggested methods for greatest efficiency and with a minimum of error.

The error in making readings on the slide rule will depend on the size of the slide rule and the carefulness of the reader and is usually less than 1 in 1,000 or one tenth of one per cent. With a 12 inch slide rule and a magnifying glass the third significant figure can be estimated satisfactorily. Where greater accuracy is needed, the equations above should be used with tables showing five-place logarithms and the slide rule method may be used as a convenient check.

Example of Multiple Equi-Drawing for Steel Wire

Pickled low carbon steel wire is drawn (dry lubrication) through a series of 14 drawing dies from .25 in. dia. (gauge no. 3, U. S. Std. plate) to .0625 in. dia. (gauge no. 16, U. S. Std. plate). The final wire speed is 2,500 feet per minute.

Find:

1. **The total elongation factor and reduction in area,**
2. **The single elongation factor and reduction in area,**
3. **The series of bore diameters of the drawing dies,**
4. **The series of wire speeds.**

Solution

1. **To find the total elongation factor, $E = (d_o/d_n)^2 = (.25/.0625)^2$, (Cf. Eq. 5), using the A, B, C, and D scales of the slide rule, (Cf. Fig. 2), push hairline to 250 (d_o) on D, set 625 (d_n) on C to hairline, opposite index of B read on A, 16.0 = E. (The decimal point, like in general slide rule operations is set after a rough, mental evaluation of the anticipated result).**
   To find the total "left-over" L, (Cf. Fig. 2), at the same slide rule

setting as above, opposite index of A read on B, .0625 = L.
The total reduction in area is then: R = (1 − .0625)100 = 93.75 per cent, (Cf. Eq. 9).

2. To find the single elongation factor, e, apply the proportion principle for Log Log scales,
$\frac{\log 16.0}{14} = \frac{\log e}{1}$ (Cf. Eq. 7),
push hairline to 16.0 (E) on LL3 (Cf. Fig. 3),
set 14 (n) on C to hairline,
push hairline to index of C,
at hairline read on LL2, 1.219 = e.
To find the single "left-over," L_1, using the same setting, at hairline read on LLO2, .820 = L_1.
The single reduction in area is then: R_1 = (1 − .820)100 = 18.0 per cent, (Cf. Eq. 9).

3. To find the series of bore diameters, using the A, B, C, D, CF, and DF scales of the slide rule,
set left index of B opposite 121 (e) on A,
push hairline to 250 (d_o) on D,
at hairline read on C, 2264 (d_1);
push hairline to 2264 (d_1) on D,
at hairline read on C, 2051 (d_2);
push hairline to 2051 (d_2) on D,
at hairline read on C, 1857 (d_3);
push . . . follow-up this procedure to:
at hairline read on CF, 625 (d_{14}).

Note. The scales CF and DF (folded scales) are the same as the C and D scales respectively, except in the position of the indices. If the readings of a series at the given slide rule setting are outside the range of the C and D scales, the use of the CF and DF scales is very convenient since one saves the trouble of moving the slide as well as the attendant source of error.

The required bore diameters of the drawing dies are: .2264, .2051, .1857, .1682, .1524, .1380, .1250, .1132, .1026, .0929, .0841, .0762, .0690, and .0625 in.

4. To find the series of wire speeds, using the same slide rule setting as for the diameters,
opposite 2500 (s_{14}) on A read on B, 2051 (s_{13});
opposite 2051 (s_{13}) on A read on B, 1682 (s_{12});
opposite 1682 (s_{12}) on A read on B, 1380 (s_{11});
opposite 1380 (s_{11}) . . . follow-up this procedure to:
opposite 195 (s_1) on A read on B, 156 (s_o).
The wire speeds are: 156, 195, 232, 283, 345, 421, 513, 625, 762, 929, 1132, 1380, 1682, 2051, and 2500 ft./min.
If the speed of the original wire is of interest only,
set index of B opposite 160 (E) on A,
opposite 2500 (s_{14}) read on B, 156 = s_o.

Example of Multiple Equi-Drawing of Aluminum Wire

Rolled aluminum wire is to be drawn through 8 drawing dies from .375 in. dia. (gauge no. 000, U. S. Std. plate) to .0781 in. dia. (gauge no. 14, U. S. Std. plate). In practice, mostly 10 drawing dies are used for this drawing operation; 8 drawing dies were chosen for this example in order to show the slide rule processing without ambiguity.

Find:
1. The total elongation factor and reduction in area,
2. The single elongation factor and reduction in area,
3. The series of bore diameters of the drawing dies.

Solution:
1. To find the total elongation factor, $E = (d_o/d_n)^2 = (.375/.0781)^2$, (Cf, Eq. 5),
using the A, B, C, and D scales of the slide rule,
set 781 (d_n) on C opposite 375 (d_o) on D, (Cf. Fig. 2),
opposite index of B read on A, 23.1 = E.

To find the total "left-over," L,
using the same slide rule setting as above,
opposite index of A read on B, .043 = L.

The total reduction in area in then: R = (1 − .043)100 = 95.7 per cent. (Cf. Eq. 9).

2. To find the single elongation factor, e, apply the proportion principle for Log Log scales,
$\frac{\log 23.1}{8} = \frac{\log e}{1}$ (Cf. Eq. 7)
push hairline to 23.1 (E) on LL3 (Cf. Fig. 3),
set 800 (n) of C to hairline,
push hairline to index of C,
at hairline read on LL2, 1.480 = e.

To find the single "left-over," L_1, using the same setting,
at hairline read on LLO2, .676 = L_1.
The single reduction in area, R_1, is then:
R_1 = (1 − .676)100 = 32.4 per cent (Cf. Eq. 9).

3. To find the series of bore diameters, using the A, B, C, D, CF, and DF scales of the slide rule,
set left index of B opposite 1480 (e) on A,
push hairline to 375 (d_o) on D,
at hairline read on C, 308 (d_1);
push hairline to 308 (d_1) on D,
at hairline read on C, 253 (d_2);
push hairline to 253 (d_3) on D,
at hairline read on C 208 (d_4);
push . . . follow-up this procedure to:
at hairline read on CF, 781 (d_5).
The required bore diameters are: .308, .253, .208, .171, .141, .116, .0950, and .0781 in.

Example of Equi-Annealings for Titanium Wire

Commercially pure titanium wire has been drawn in two passes from .1875 in. dia. (gauge no. 7, U. S. Std. plate) to .143 in. dia. and had to be annealed. The final diameter of the wire is .0375 in. dia. (gauge no. 20, U. S. Std. plate). It has been decided to divide the necessary, remaining annealings into even stages similar to the first annealing.

Find:
1. The elongation factor for the total drawing process.
2. The elongation factor for the first annealing stage.
3. The total number of annealings required.
4. The elongation factor for the remaining drawing process.
5. The elongation factor for the remaining single annealings.
6. The series of diameters where the wire is to be annealed.

Solution:
1. To find the total elongation factor, $E = (.1875/.0375)^2$, (Cf. Eq. 5), using the A, B, C, and D scales of the slide rule,
set 375 (d_n) on C opposite 1875 (d_o) on D, (Cf. Fig. 2),
opposite index of B, read on A, 25.0 = E.

2. To find e_1 for the first annealing stage,
$e_1 = (.1875/.143)^2$, (Cf. Eq. 5),
set 143 (d_1) on C opposite 1875 (d_o) on D, (Cf. Fig. 2),
opposite index of B read on A, 1.73 = e_1.

3. To find the total number (n) of the annealings, apply the proportion principle for Log Log scales,
$\frac{\log 25.0}{n} = \frac{\log 1.73}{1}$ (Cf. Eq. 7),
push hairline to 1.73 (e_1) on LL2, (Cf. Fig. 3),
set right index of C to hairline,
push hairline to 25.0 (E) on LL3,
at hairline read on C, 5.87 (n).
The nearest integer to 5.87, that is, 6, is the number of all annealings required. (The first annealing being perfected, 5 annealings remain to be evaluated.)

4. To find the total elongation factor for the annealings from the first to the final,
$E_{1\text{-}6} = (.143/.0375)^2$, (Cf. Eq. 5),
set 375 (d_6) on C opposite 143 (d_1) on D,
opposite index of B read on A, 14.5 = $E_{1\text{-}6}$.

5. To find the single elongation factor, e, for the 5 remaining annealings, apply the proportion principle for Log Log scales,
$\frac{\log 14.5}{5} = \frac{\log e}{1}$ (Cf. Eq. 7),
push hairline to 14.5 ($E_{1\text{-}6}$) on LL3, (CF. Fig. 3),
set 5 (n-1) on C to hairline,
push hairline to index of C,
at hairline read on LL2, 1.708= e.

6. To find the series of the wire diameters for the annealings,
using the A, B, C, D, CF, and DF scales of the slide rule,
set left index of B opposite 1708 (e) on A,
at hairline read on C, 1090 (d_2);
push hairline to 1090 (d_2) on DF,
at hairline read on CF, 8375 (d_3);
push hairline to 8375 (d_3) on DF,
at hairline . . . follow-up procedure to:
at hairline read on CF, 375 (d_6).
(The last reading is not required but serves as a check.)

(*Please turn to page* 1193)

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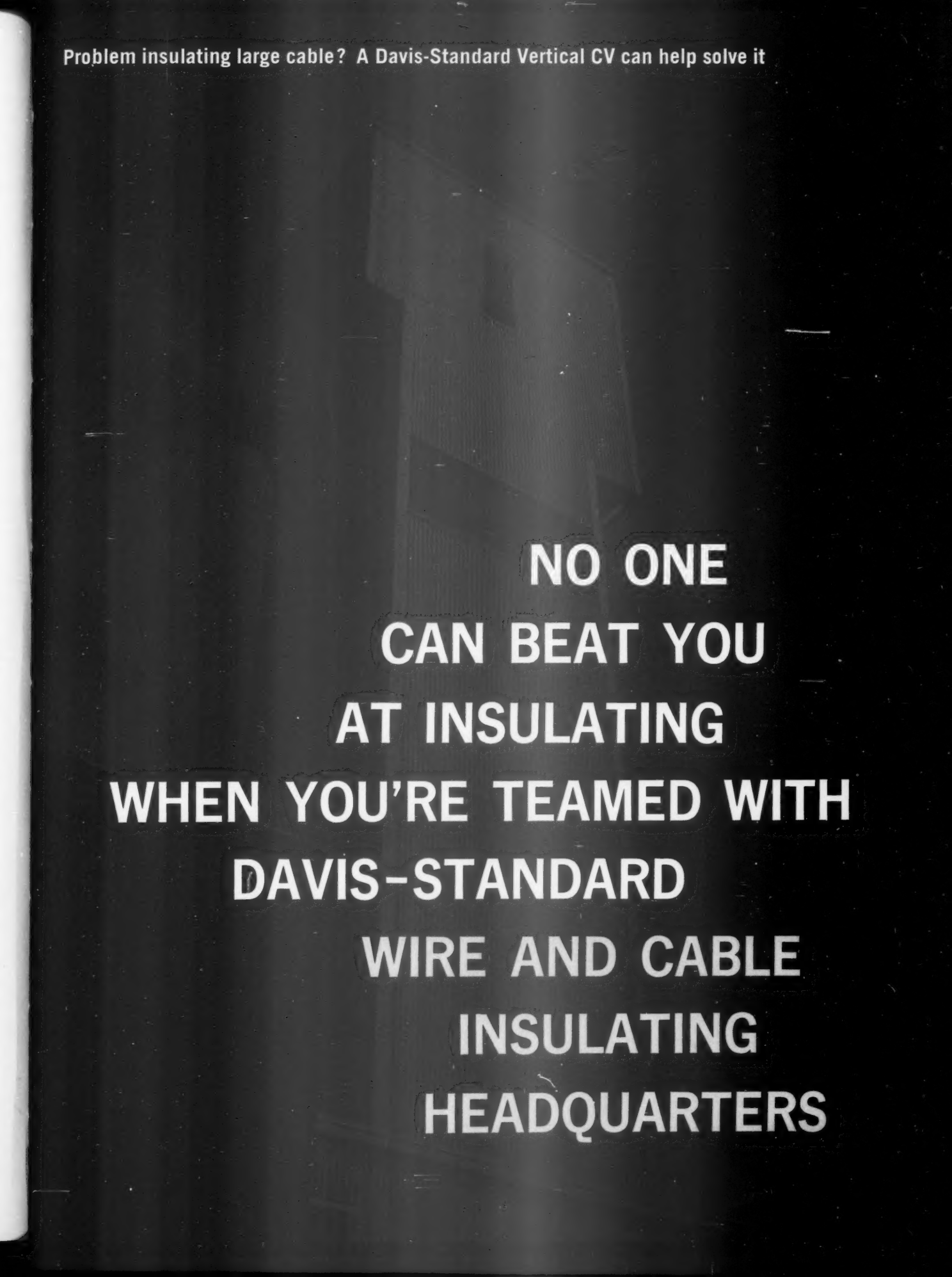

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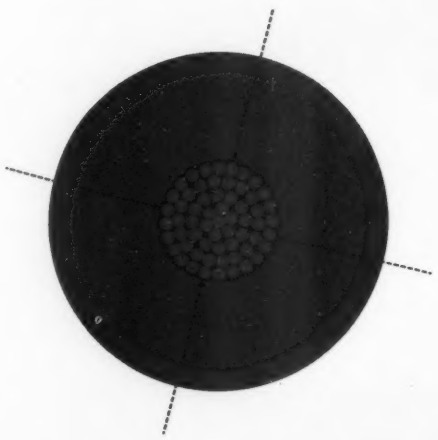
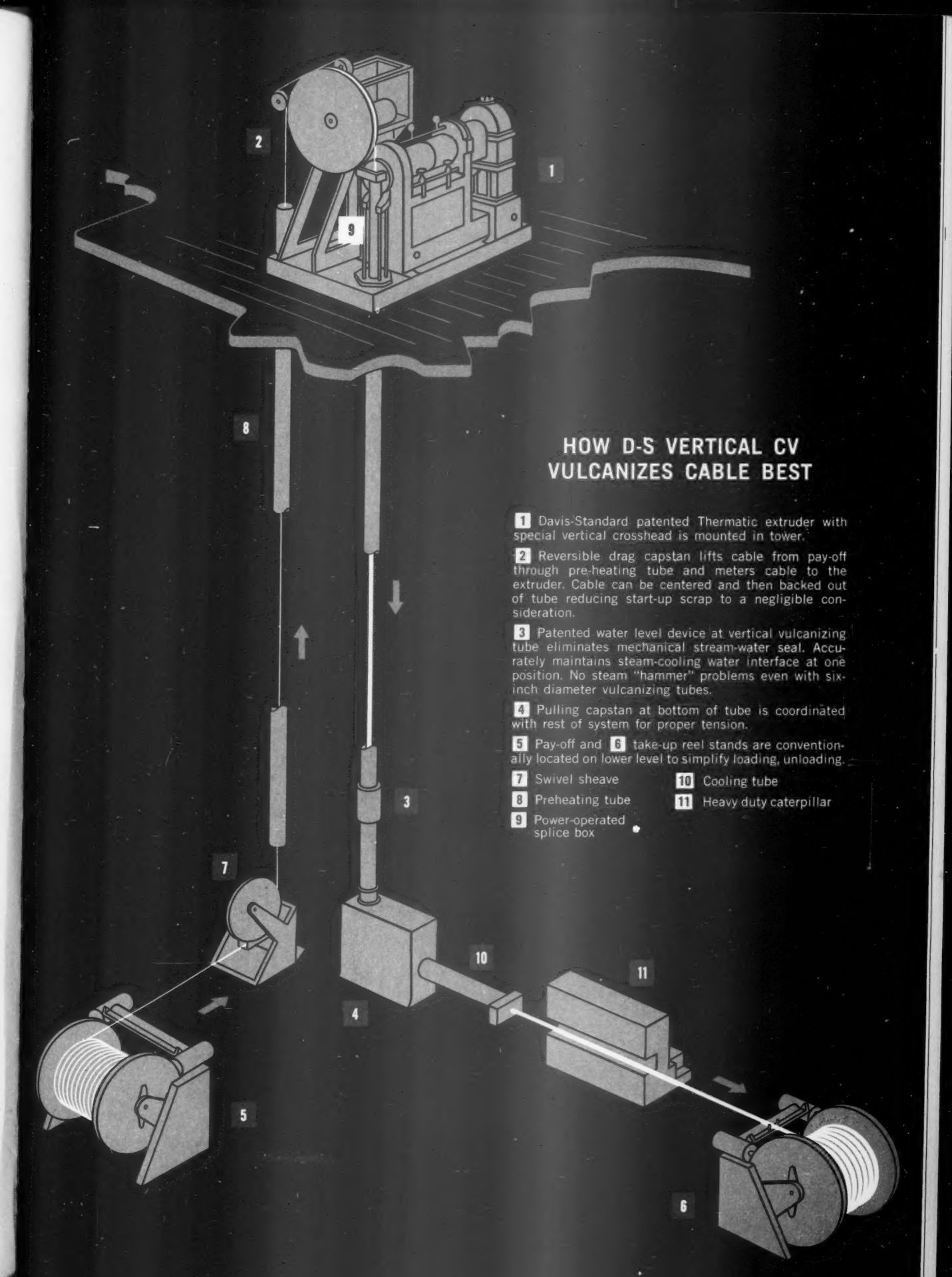


CV tower photo courtesy Kaiser Aluminum & Chemical Corporation



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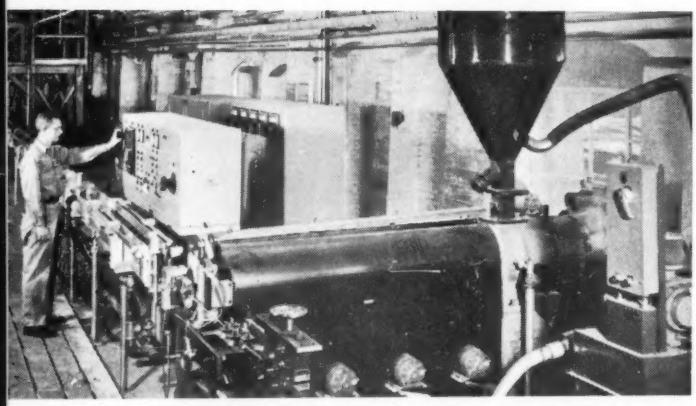

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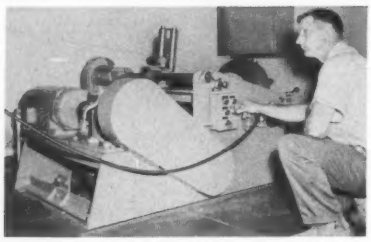

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The Importance of Wire in Spring Design

by Hal McVey
Connor Spring Manufacturing Company
San Francisco, California

A paper presented at the West Coast Regional Meeting of The Wire Association on June 22, 1961, at San Francisco, California.

Importance of Wire—A Point of View?

One year ago a representative of our Company was called into a stamping firm to help solve a spring problem that had caused the loss of three fingers by a machine operator. Die springs on the "home made" punch press on which he was working had fractured and contrary to good safety practice this had allowed the ram of the press to drop instead of being automatically locked into the up position. We were called in to design springs that would prevent recurrence of the same accident. Calculations showed springs to be safe if a high allowable stress wire were used. Our proposal recommended valve quality, chrome vanadium oil tempered wire with a secondary shot peen to increase physical properties. This, along with the new price, slightly higher than the original springs due to more expensive wire, was submitted. When the superintendent, who had originally requested our aid, saw that improved springs would cost slightly over $10.00 he rejected the complete idea and decided to stay with springs utilizing the former low allowable stress wire.

* * *

His lack of regard for quality wire in mechanical coil springs would not have been shared by the operator that lost three fingers and neither is it shared by spring manufacturers. For we know that without proper quality wire we can in no way hope to manufacture precision springs.

Wire Characteristics and Spring Manufacturing

Many characteristics of wire are particularly important to the spring manufacturer. Three of these: wire diameter, cast of wire, and torsional stress are discussed below.

Wire Diameter

For the most part there is clear understanding between wire mills and spring makers on importance of wire diameter but due to the exaggerated effect of a small change in wire diameter upon load specifications of springs it is well to consider an example of this effect. The following design shows what a few thousandths difference in wire diameter does to rate (deflection in pounds per inch) of a compression spring:

Spring Specifications:		
Outside Diameter	1"	
Active Coils	7	
Type of Wire	Music	
Diameter of Wire	.080	.095
Rate (lbs./inch.)	10.8	22.6
Increase in wire	18.7%	
Increase in rate	104.5%	

* * *

Recently we had a sizeable spring problem simply due to the fact that wire was received from mill on high side of tolerance. Spring specification called for .125 diameter stainless steel but shipment from mill arrived as .126 (within tolerance but not usable because that one extra thousandth increased the rate and load of spring so it no longer complied with specifications.) This was a case where .001 in .125 made the difference between a good spring and a rejected part.

* * *

Wire diameter is a peculiar property that cannot be over emphasized when working in spring design and is, of course, the reason the spring manufacturers at times request closer than commercial tolerances on diameter of wire.

Cast in Hard Drawn Wire

The head coiler in Connor's San Francisco Plant is a spring maker with three decades of experience. When asked what one characteristic he could single out as causing him the most difficulty in spring fabrication his immediate answer was that of "cast to hard drawn wire." Cast in this instance is that property of wire that would cause a single coil to lay in something other than a plane when placed on a flat surface. This would mean that the coil would have a tendency to spiral upward. This is not to be confused with the property of hard drawn wire where a single coil would retain a circular shape conforming to the diameter of the bundle. This latter can be removed if desired by straightening through rolls.

* * *

Erratic cast in wire causes spring pitch (distance between coils) to vary which in turn makes it extremely difficult to control free length of spring. In close tolerance springs, where precise free lengths and loads are specified, we must discard wire with a cast and change to a roll without cast in order to meet customer specifications.

* * *

We fully realize that testing for cast during the drawing process is difficult as it would require stopping the draw to check for this property specifically. It would, however, help to work toward a clearer understanding as to what would constitute acceptable tolerance as pertains to cast. This would allow the spring manufacturer to specify quality wire for precision spring applications where consistent cast is required.

(*Please turn to page* 1191)

Polymer Requirements and Insulating Techniques for Obtaining the Maximum Benefits of High Density Polyethylene

by R. J. Ettinger, Manager
Plastic Sales Service Laboratory
Goodrich-Gulf Chemicals, Inc.
Cleveland, Ohio

This paper was presented at the Ninth Annual Symposium on Technical Progress in Communication Wires and Cables held at Asbury Park, N. J., from November 30 through December 2, 1960, under the auspices of the U. S. Army Signal Research & Development Laboratory, Fort Monmouth, N. J.

Introduction

Four years ago, the electrical trade tested a new polymer—high density polyethylene — which seemed destined to further improve the future products of the wire and cable industry. The abrasion resistance and toughness of high density polyethylene were needed for thin wall wire constructions. However, this material did an about-face and failed badly in both initial and subsequent trials. It stress cracked rapidly and showed extremely poor resistance to thermal embrittlement. In addition, insulation on covered wire cracked rather rapidly in elevated-temperature water bath tests. It seemed obvious, therefore, that early high density polyethylenes had no major potential in the wire and cable industry, an industry that demanded long time, high insulating characteristics. All of these properties have been substantially improved in some—but not all — high density polyethylenes. Today, with the proper methods and equipment, quality wire extrusions can be made from high density polyethylene. Insulating wire with high density polyethylene requires definite skills and techniques. This paper outlines some of those techniques that help overcome the processing problems often encountered with these polymers.

* * *

Because of the early difficulties, high density polyethylene was not well received by wire people. It was evident that this material extruded at rates slower than those obtained from their low density counterparts. The surface finishes of the wire insulations were rough; necessary dimensional tolerances were not easily obtained. Actually, acceptance was so poor that a major portion of the wire industry assumed that high density polyethylene would not be suitable for insulation purposes. But since then, considerable amount of development work has been undertaken to overcome this initial severe setback. The outcome of this work has been the commercialization of a few useful wire insulating grade high density polyethylenes. Improvements in polymerization techniques for high density polyethylenes have resulted in polymers possessing better stress cracking and thermal embrittlement properties. Previously, most high density polyethylenes cracked quite readily under continued stress at temperatures above 50°C.

* * *

Polyethylenes can now be made which are virtually free from thermal cracking, provided the insulation is correctly applied. The use of the wire preheater, the manufacture and design of wire tips and dies, and proper water bath temperatures play a very important part in making a good finished wire product.

* * *

Only very high molecular weight polymers will provide the wire industry the full benefits possible from high density polyethylene. This is also generally true of other types of plastics. As the molecular weight increases, however, polyethylene becomes more viscous and much more difficult to extrude, making it necessary to develop new techniques for commercial wire application of these high molecular weight polymers at reasonably fast production rates.

Physical Properties

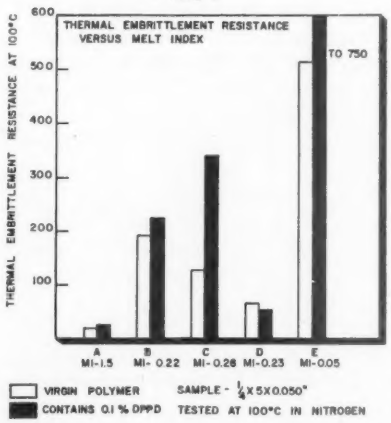
During the early wire work with high density polyethylene, cracking occurred rapidly at elevated temperatures. Studies showed that the time required for these fractures to occur was independent of the environment—whether a vacuum, nitrogen, or other inert medium. Such action strongly suggested that some form of thermal degradation, rather than oxidation, was occurring. In many cases, thermal embrittlement failures far exceeded failures from stress cracking.

* * *

Thermal embrittlement studies were made in which insulation wire was wrapped on itself; the insulation readily cracked when exposed to elevated temperatures. This type of test has not been completely satisfactory because of the effect of insulation thickness. Insulations on No. 14 or larger wires usually show no signs of thermal cracking, unless the high density polyethylene has such a low molecular weight that it breaks under stress at room temperature.

Other thermal embrittlement tests were conducted by wrapping a 0.050-inch thick strip of polyethylene around a 1/4-inch brass rod in a nitrogen atmosphere at 100°C. This procedure was developed at the Bell Telephone Laboratories by Heiss and Lanza.[1] Figure 1 shows a plot of melt index versus thermal embrittlement resistance (TER) for five high density polyethylenes produced by three manufacturers.

FIGURE 1

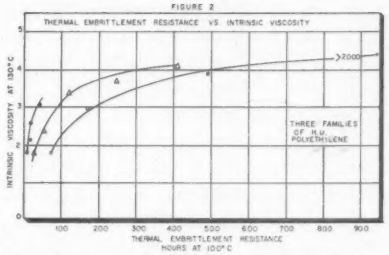


These polyethylene families show distinct differences in TER. Obviously, TER improves as the melt index is reduced; but melt index alone does not describe the life span of these polymers. For example, polyethylenes B and D have almost equal melt index characteristics, yet their TER values differ by approximately 150 hours. The very high molecular weight polyethylenes have exceptionally good TER behavior, as shown by example E. All polymers which have been examined with a melt index of 0.15 or below have TER values of at least 750 hours. High density polyethylenes with melt index values as low as .02 can be readily extruded on wire at commercial speeds.

* * *

Thermal embrittlement resistance vs. Intrinsic Viscosity curves of several high density polyethylenes, produced by three different manufacturers, are plotted in Figure 2. It is important to note that each family has an individual TER curve. More important are the wide variations of TER among polymers of the same Intrinsic Viscosity. At an I.V. of

FIGURE 2



1.8, for example, the TER varies from about 14 hours to 70 hours. Even more striking are the differences in the I.V. range of 3.8 to 4.4 which show TER values between 400 to greater than 2000 hours. Obviously, selecting a high density polyethylene for wire insulation requires a detailed examination of each polymer under consideration.

* * *

The use of antioxidants for stabilizing high density polyethylene against thermal embrittlement is mandatory, and a given concentration of antioxidant imparts greater stability to higher molecular weight polymers than to lower molecular weight polymers. Generally, stabilization can be readily accomplished with polyethylenes having melt indexes less than 0.2 coupled with intrinsic viscosities of 3.8 or higher. Although there are no fast rules or parameters governing these limits, it is generally true that the lower molecular weight high density polyethylenes have poor thermal embrittlement resistance.

* * *

The addition of such materials as polyisobutylene or polybutene-1 will help improve TER and stress cracking resistance. Such additives, however, do not provide nearly the improvements in properties accomplished by a small increase in the molecular weight of the high density polyethylene. Addition of channel black to high density polyethylene also helps stabilize it against thermal embrittlement; but again, the basic faults of the lower molecular weight polymers are not corrected by using this material. Carbon black in polyethylene is restricted to jacketing.

* * *

The success of high density polyethylene wire insulation is dependent on the use of the very high molecular weight polymers. With lower molecular weight materials, problems with stress cracking or thermal embrittlement are certain to occur.

Stress Cracking

The Bell Laboratories Thermal Embrittlement Apparatus was used in a study of the stress cracking resistance of high density polyethylene. The five polymers tested in this work came from four different manufacturing processes. Their melt indexes ranged between 0.20 and 0.45. Figure 3 lists the results of the studies, using various immersion mediums.

FIGURE 3

STRESS CRACKING RESISTANCE AT 50°C *

IMMERSION MEDIUM	POLYMER A	POLYMER B	POLYMER C	POLYMER D	POLYMER E
NITROGEN	>1500	>1500	>1500	71	>1500
DISTILLED WATER	>1500	>1500	>1500	66	>1500
IGEPAL CO630	192	>1500	550	12	>1500
IGEPAL & DH₂O (50/50)	70	360	190	7	216
LIQUID JOY**	50	>1500	>1500	16	486

Using the Bell Laboratories thermal embrittlement apparatus in which a strip of polyethylene 1/4 x 5 x 0.050 inches is wrapped on a 1/4 inch brass rod.
Manufactured by the Procter and Gamble Company.

All of the polymers tested have varying stress cracking lives. Some of these variations are quite large in contrast to the rather small spread in melt index, showing the importance of molecular weight to stress cracking resistance. The data also indicates that the test is accelerated in a 50-50 mixture by weight of Igepal CO630 and distilled water.

* * *

Work in the Goodrich-Gulf laboratories has demonstrated that thermal embrittlement and stress cracking can be avoided best by following these rules:

1. **Use the highest molecular weight polymer possible.**
2. **Add a suitable antioxidant.**
3. **Add channel black where possible.**

Insulation Resistance

The insulation resistance of a number of high density polyethylenes was studied over periods of time at 75°C. The tests were made on coils of No. 20 wire, insulated with a 0.016-inch wall of high density polyethylene. The coils were immersed in a water bath which served as an aging medium as well as a convenient method of completing the test circuit. The insulation resistance

itself was measured at 500 volts for one minute.

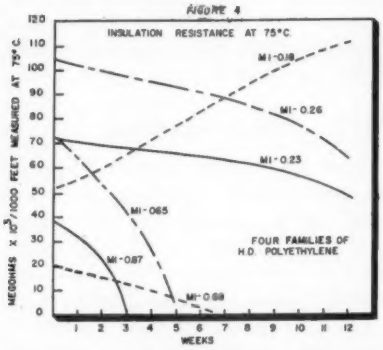


Figure 4 shows the insulation resistance of six high density polyethylenes measured over a twelve-week period. These polymers contained no additives. The insulation resistance values of these polyethylenes are as badly scattered as the thermal embrittlement and stress cracking data. As in the other tests, some of the polymers cracked, causing the wire to short. Most of the shorting occurred with the lowest molecular weight polymers as shown by their melt indexes. Figure 4 shows only a portion of the polyethylenes that were studied. Actually, more than 85 per cent of the tested high density polyethylenes shorted during the twelve-week cycle.

* * *

The tensile properties of the polymers that passed the insulation tests were appreciably reduced as a result of the aging. The ultimate tensile strength fell from 5100 psi to 3600 psi, and the elongation dropped from 580 per cent to 40 per cent. It must be remembered, however, that these samples did not contain antioxidants. And even after a year's aging, these higher molecular weight polymers which passed the insulation tests still did not crack when wrapped on their own diameter, nor did they show any further evidence of tensile property deterioration.

* * *

A large drop in tensile properties during any aging period is a serious problem, considering the life span required for wire insulation. In efforts to upgrade the aging characteristics, studies were undertaken to determine the effect of antioxidants and carbon blacks. The laboratories examined over 150 antioxidants for natural polyethylene, and the most effective stabilizer found is Age-Rite White (N, N'-Di-B-naphthyl-p-phenylenediamine). This material is difficult to disperse in polyethylene and must be incorporated at temperatures above 400°F. to be most effective. Insulation tests covering four months have been completed on high molecular weight polyethylene containing AgeRite White. To date, these tests show no loss in tensile properties and further work is continuing.

* * *

AgeRite White has been found ineffective in black polyethylene compounds. Contrary to popular belief, the action of antioxidants is severely inhibited when carbon black is incorporated into the polyethylene. This was true for all antioxidants investigated. Even with this drawback, polyethylenes containing 3 per cent channel black have excellent insulation resistance, with no loss in tensile properties after aging for one year in water at 75°C.

Tip and Die Design

The die geometry required for extrudng high density polyethylene is quite complex and not completely understood. Die design has been discussed by Hammond[2] and by Lowe and Joyce[3]. Both of these papers show that the die must be tapered at the entrance and must be of sufficient size so that the critical extrusion rate of the polymer is not exceeded. When the critical rate of polyethylene extrusion is exceeded, the extrudate is rough in appearance. The Goodrich-Gulf laboratories have taken a different approach to achieve essentially the same effect discussed by the authors just mentioned.

* * *

Figure 5 shows the design of a unique wire tip which restricts the rate of flow. This design was chosen because it may be produced readily by a skilled machinist and without the necessity for any unusual shop tools. Regardless of the approach taken, it is necessary to retard flow somewhat to prevent melt fracture of the polymer.

* * *

The exit taper of the wire die is definitely related to smooth, fast, wire extrusions. The effect of taper on the exit pressures has been described by Hammond, and his data have been confirmed. Figure 5 shows a table of the rates and pressures developed when extruding a 0.016-inch wall of 0.2 melt index high density polyethylene on No. 20 wire.

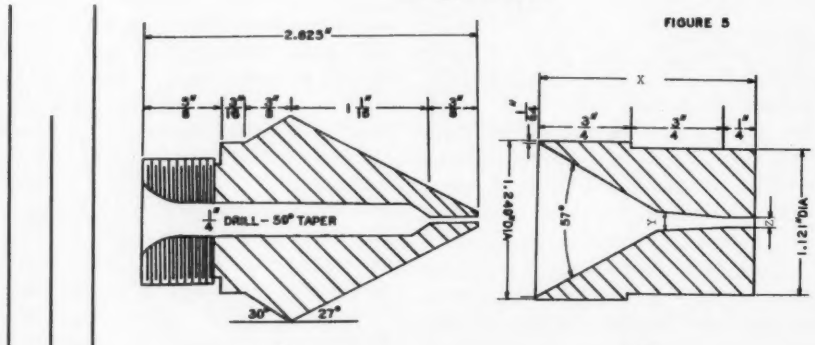
* * *

Dies A, B, and C have an eight

(*Please turn to page* 1183)

WIRE TIP & DIES

FIGURE 5



TIP DIE

Die	X	Y°	Z	Crit. Rate°	Head Press. Psi	Errtn. Rate°	Head Press. Psi
A	1.50	8	.064	1200	6200	.....	.....
B	1.50	8	.070	1450	6700	.....	.....
C	1.50	8	.084	1850	7600	.....	.....
A	1.50	8	.064	.....	.....	1000	5850
D	1.50	16	.064	.....	.....	1000	6650
E	1.50	24	.064	.....	.....	1000	7750
F	1.75	16	.064	.....	.....	1000	6950
G	1.75	24	.064	.....	.....	1000	8150

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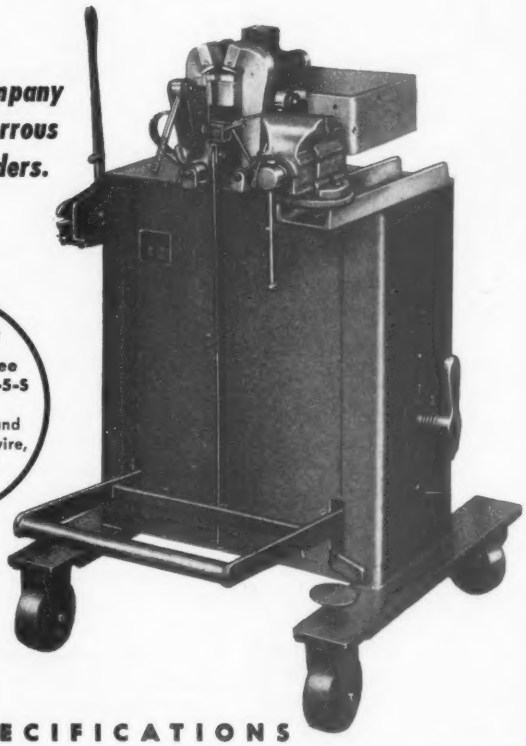

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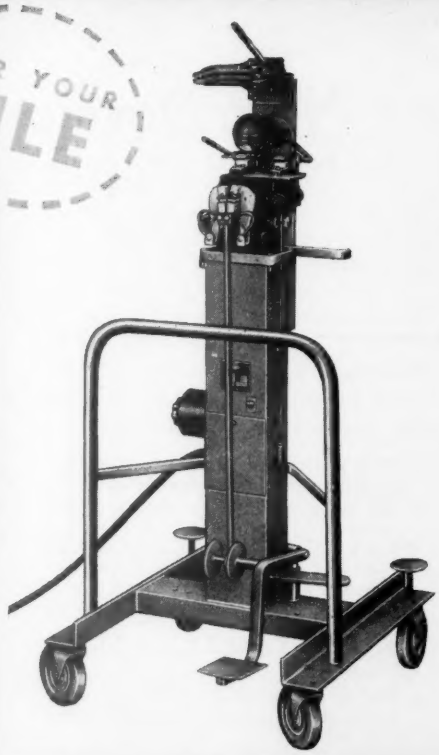

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J-3-S	.020" to .080" diameter
J-4-S	.040" to .160" diameter
J-45-S	.060" to .200" diameter
J-5-S	.080" to .250" diameter

FOR WELDING FERROUS WIRE & RODS	
MODEL	CAPACITY
J-6-S	.250" to .375" diameter
E	.035" to .225" diameter
T-L	.080" to .375" diameter
T-HD	.125" to .625" diameter
H.T.	⅛" to ¾" diameter
MD-3	.375" to .750" diameter
MD-4	.375" to 1.000" diameter

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Charter Member — The Wire Association

New Developments in Wetting Agents

by Carl Alex Fischer
Works Manager
Fischer & Company
Reinach, Switzerland

Wetting agents are chemicals known as acid activators, which have the following advantages:

1. They intensify the attack by the acid on the material being pickled.
2. The pickling time can therefore be reduced.
3. Efficient pickling is possible even with lower acid concentrations, as activated acid attacks the metal much more strongly than acid in the normal condition.
4. Considerable savings in acid are thus possible.
5. The metal surface is uniformly wetted by the acid, hence the term "wetting agent".
6. In the acid bath wetting agents develop a foam blanket of a thickness depending on conditions, and this largely prevents the formation of harmful vapours from the pickling bath. In this way cranes and other steelwork are largely protected from corrosion and so require less maintenance.

* * *

Wetting agents were originally only used for electroplating. Thus even today the numerous products on the market are mainly intended for this purpose. But for some time the author has been occupied with the idea of using wetting agents experimentally as a constituent of pickling liquors.

* * *

Numerous laboratory and works tests were necessary to arrive at usable and reliable results. Of course in this complex field development is by no means ended, since the steady improvement in wetting agents enables ever better results to be achieved.

* * *

The experiments described in the first article were mainly concerned with the wetting agent HW 54 manufactured by Wagner & Co. of Zurich. This product has already been superseded. The makers have therefore developed a wetting agent that is even more effective and economical in use, and numerous trials have been carried out with this in our works. Although the sample supplied has proved generally satisfactory, at the time of writing the new wetting agent requires a number of modifications to make it suitable for the most difficult working conditions; only when this has been done will it be marketed by the manufacturer.

Carl Alex Fischer

The July 1959 issue of "Wire Industry" contained an article by Mr. Fischer entitled: "Recent Tests on Economical Cleaning of Unalloyed Low Carbon Steel, Using a Wetting Agent". In this article the author dealt thoroughly with the subject of wetting agents. However, to facilitate the reader's understanding of the present paper, he recalls briefly the main characteristics of wetting agents.

* * *

Above all, tests show that the new product, HW 592, creates such an intensive initial acid activity that the resulting increase in hydrogen generation causes an appreciable drop in pickling rate in a relatively short time, so that acid consumption is increased. To overcome this disadvantage as far as possible, an inhibitor had to be added, to keep the activity of the acid activator within reasonable limits.

* * *

This led to the development of a combined wetting agent and inhibitor. If the amount of inhibitor is too great in comparison with the actual wetting agent or acid activator, pickling times become appreciably longer, and this may cancel out the advantages of the wetting agent. It is therefore most important to obtain the right proportion of constituents.

* * *

This is one of the main problems in the attainment of the highest degree of efficiency of a combined wetting agent. For this reason the HW 592 has not yet reached its maximum performance. Further tests are therefore necessary and these should certainly give even better results.

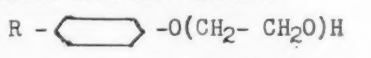
* * *

Not the least important factor is the choice of a suitable inhibitor. Our tests show that good results are obtained with an addition of 2 to 3 dl of Rodine 57 per 4000 litres of pickling liquor. To this acid bath the wetting agent HW 592 was added in the proportion of 0.05% per litre of bath. We thus see that the consumption of wetting agent is very small on account of its activating effect on the acid, as already mentioned. The quantity would probably be somewhat lower in the future. The H_2SO_4 concentration and bath temperature must naturally be taken into account too. As with the earlier tests, these pickling baths were operated with acid concentrations of 10 to 15%, depending on whether the acid used was old or treated or whether it was completely fresh.

* * *

On the other hand excellent results have so far been obtained with Marlophene, the working details being practically the same as with HW 592. Eight different types of Marlophene are marketed, of which only types 89 and

810 were used in our experiments. According to the manufacturers this product consists of non-ionic surface-active compounds with the formula:



Where R = alkyl residue (generally 6 to 12 atoms)

= the number of added molecules of ethylene oxide.

* * *

Marlophene was developed by the chemical firm of Huls in Marl (District of Recklinghausen, Germany) as a non-ionic detergent constituent, which however can also be used as a degreasing agent in the metal industry. Marlophene forms the basis of auxiliary materials for textile and leather manufacture and is also used as a wetting agent in the cellulose and paper industries.

* * *

Since Marlophene, being a non-ionic compound, is very stable in the presence of acids, alkalis and salts, these products would appear to be eminently suitable for use with H_2SO_4, which is customarily used in our trade. It was therefore included in our series of tests. The specialist will certainly be interested to know the basis on which the various Marlophene types are built up. In principle they consist of a high-grade alkylphenol. At room temperature Marlophene 89 is a viscous, yellowish oil, whereas Marlophene 810 is a thick paste.

* * *

Extensive tests with these two wetting agents confirmed the experience previously obtained with other wetting agents. Accordingly, the effectiveness of a wetting agent is much greater when the total quantity required is added in several instalments than when it is added all at once. Thus, for the Marlophene types also, it was found that it is generally unnecessary to exceed a total addition of 1% per bath litre. Depending on the condition of the scale to be removed and on the degree of purity of the H_2SO_4, the optimum quantity lies between 0.05% and 0.1%. The addition is made in two to three instalments.

Just as with the wetting agents tested previously, H_2 generation is much too intensive when Marlophene is added to the acid bath without pickle-economising additives, with the results already mentioned. Some Rodine 57 was therefore added to the wetting agents.

* * *

Tests were also carried out with Adacid as well as with a mixture of the two pickle economisers referred to. The results were fully up to expectations, experience showing that preference might in the long run be given to Marlophene 810 with Adacid.

* * *

It is important when filling the pickling tank to ensure that both the wetting agent and pickle economiser are well distributed right from the start, in order to use their full activation capacity as soon as possible. This is even more important when using pickle economisers in the form of a powder instead of a liquid. In principle the wetting agent can be added either to a cold pickling bath or to one that has already been preheated; the former alternative was found to be preferable in practice.

* * *

In order not to use up the capacity of the wetting agents unnecessarily, the working temperature should be held within certain limits. Taking into account the fact that heat is released by the reaction between the acid and metal and that the addition of a wetting agent further raises the temperature a few degrees, a starting temperature of 45 to 50° C is quite adequate for a low-carbon steel.

* * *

In addition, the temperature has a considerable influence on the solubility of Marlophene in water. As with all non-ionic types, this decreases with increasing temperatures. The results of numerous experiments show that, so far as possible, the bath temperature should not exceed 70° C. At temperatures of 45 to 50° C the pickling baths have a longer useful life than at higher temperatures.

It was interesting to compare the acid consumption per ton of pickled metal (a) **without** and (b) **with** wetting agent. The average figures were (a) 10-11 litres and (b) 7.5-8 litres. However, these figures will not be generally valid: they depend greatly on the purity of the acid and on the condition of the scale on the metal, and to a certain degree on the pickling plant.

* * *

As with the other wetting agents, Marlophene 89 and 810 altered the surface tension of the pickling baths, resulting in better wetting of the metal surface. The metal was therefore pickled much cleaner.

* * *

It was found, however, that rolled wire that has been pickled in an acid bath containing wetting agent is unsuitable for copperplating. The reason for this was for a long time obscure, the more so as the wetting agents used, being non-ionic products, had proved highly successful for pickling. No opaque film could be detected on the surface. The problem has since been solved by an Italian professor of chemistry. He traced it to the arsenic content of the H_2SO_4, which normally should not exceed 10 mg/litre, otherwise a deposit forms on the metal. In the ordinary way 5 to 10 mg of arsenic per litre is harmless. In combination with the wetting agent — presumably as a result of its activating effect on the H_2SO_4 — this impurity immediately becomes evident. The fault can, however, be remedied by using sulfuric acid of 66° Be instead of 60° Be. With this higher degree of purity the arsenic content is only 2 to 5 mg per litre, which can be considered practically arsenic-free.

* * *

Numerous tests showed that Marlophene 89 and 810 do not in any way affect the salts that cause water-hardness. Even with very hard water these salts are not precipitated. This fact is very important for pickling plants using this kind of water.

* * *

Another factor of considerable importance is suitable foam for-

mation. It is therefore worth while paying close attention to this matter, which plays a key role in all synthetic wetting agents. Foam quality largely depends on the molecular weight of the wetting agent used. In addition, foam formation generally increases with increasing water-solubility of the wetting agent.

* * *

In contrast to the intensive, relatively airy but nevertheless tough foam formation of the earlier HW 592, Marlophene 89 and 810 and the new HW 592 produce a compact, homogeneous though somewhat thinner foam covering. As the foam of all other wetting agents was of a higher specific gravity, like that of the old HW 54, it is removed more easily by the rinsing water. More important is the fact that a greater quantity of foam remained in the acid bath when the metal was lifted out. It was thus possible to ensure that less of this foam, which is in any case neutral, reached the rinsing water. Additional equipment in the pickling department absolutely prevented the discharge of any foam into the public sewer.

* * *

It has also been found in practice that during the pickling process broken-off pieces of scale are carried to the surface by the convection currents in the acid bath and are thus absorbed by the foam. If this iron oxide does not fall back into the pickling bath, then it does not react with the H_2SO_4 to form iron sulphate. Consequently the acid consumption, which can easily be determined by weight measurements, is greatly reduced.

* * *

In order to assist as far as possible the movement of broken-off scale particles into the foam blanket, the following criteria should be borne in mind:

a) The foam should as far as possible be of a creamy consistency. A medium specific weight is required. If it is too great, the iron particles mentioned will be distributed less regularly. It can also happen under these conditions that the particles lie in the lower region of the foam covering and therefore approach too closely the pickling bath itself; this results in the formation of unpleasant tarry substances, as we shall see later. If on the other hand the foam is too light, too much will be carried over into the rinsing tank when the metal is removed from the acid tank, as already briefly mentioned. This means further that one must keep adding wetting agent at frequent intervals in order to ensure proper foam formation; this would involve excessive consumption of wetting agent.

* * *

It is possible to achieve the foam properties necessary under the above-mentioned conditions by means of a so-called "stabiliser", which increases the surface tension of the bubbles, i.e. reduces the size of the foam bubbles.

* * *

In principle, it should thus be possible to determine the limiting range of the optimum specific weight. The necessary practical experience for confirming these purely theoretical considerations is still lacking.

* * *

b) The arrangement of the heaters in the pickling tank is also very important. They should in principle be located on the bottom of the pickling tank, or at least low down in the corners of the tank; in this way the heat can drive the particles upwards, so that they are caught in the foam.

* * *

If, on the contrary, the heating elements are arranged at the side, the heat will drive the separated scale particles in approximately elliptical paths in the pickling bath until they settle on the bottom. This will result in the production of more $FeCO_4$, so that the consumption of H_2SO_4 will be increased.

* * *

Even in the former case it is impossible to ensure that all the separated scale particles are caught in the foam. A certain proportion of them will in any case drop to the bottom and fall directly on the heating elements, unless these have been skilfully installed or otherwise protected. However, apart from actual iron attack on places initially free of scale, $FeSO_4$ formation is greatly reduced.

* * *

In order to promote the penetration of larger quantities of scale particles into the foam blanket, there is also the theoretical possibility of adding "floatation additives". These are foam-forming substances that reduce the specific weight of the particles and so assist their entry into the foam blanket. No practical tests in this field have so far been carried out in our works.

* * *

Unfortunately, the retention of oxide particles in the foam blanket has one big disadvantage, and this should be mentioned here. The scale particles surrounded by the foam are no longer in direct contact with the acid bath but only with a part of the hydrogen released, which cannot be excluded by the foam blanket. The

(*Please turn to page* 1187)

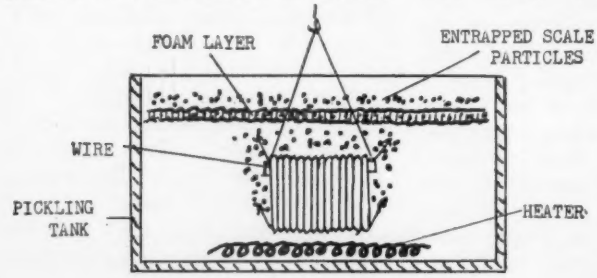


FIG. A - CORRECT ARRANGEMENT

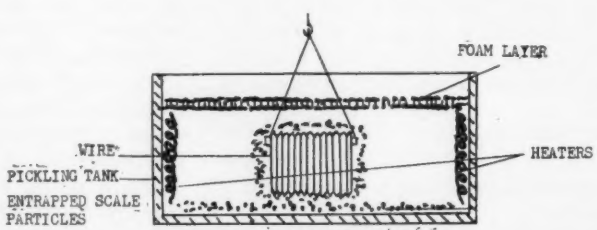


FIG. B - BAD ARRANGEMENT

Method for Tripping Power Circuit Breakers

by H. B. Ashenden, Engineer
Boston Works
Allis-Chalmers Manufacturing Company
Boston, Massachusetts

The most important function of a power circuit breaker is to open the circuit and interrupt the current during abnormal conditions (i.e., overloads or faults) to protect lines and equipment, and maintain continuity of service. Several methods of doing this are available. Merits and limitations of each are detailed here. Power circuit breakers are in use throughout the wire industry to protect and control electrical systems.

A majority of power circuit breakers are held in the closed position by a mechanical latch and are opened by releasing the latch by movement of a small solenoid or solenoids. In most cases the plunger or armature of the small solenoid actually strikes the latch or trips it by impact. For this reason it is customary to state that a breaker is tripped rather than opened. The small solenoids are usually referred to as trip coils.

* * *

Some source of energy is necessary to operate these small solenoids. It must be dependable and available at all times regardless of any fault or other abnormal condition on the circuit the breaker is protecting. Fundamentally, the method of tripping is determined by the source of energy regarded as satisfactory for the particular application.

* * *

Only three sources of energy are regarded as sufficiently reliable for tripping power circuit breakers during fault conditions. They are: (a) energy from a storage battery, (b) energy from a capacitor, or (c) energy from a current transformer.

* * *

In place of "C" it is possible to use a coil connected in series with the line to energize the small tripping solenoid. For practical reasons, including the difficulty of satisfactory insulation, series coils are usual practice only on low voltage power breakers rated 600 volts or less. At higher voltages, current transformers which provide a small low voltage current proportional to the primary current are safer, more practical, and customary.

* * *

Breakers may also be opened by energy from a low voltage ac source, but this is not considered reliable during abnormal conditions. Low voltage ac trip is used only for switching in combination with "C" above. The reason for regarding this source of energy as unreliable is obvious since a low voltage ac source is almost invariably tied in directly or indirectly with a circuit which the breaker is protecting. During a severe fault, voltage may become very low with the result that energy to trip will not be available when it is most needed.

Tripping Methods Described

The various types of tripping commonly available in modern power circuit breakers may be conveniently classified as follows:

1) Tripping from energy supplied by a storage battery controlled by relays. This is commonly referred to as dc trip (see Figure 1).

2) Tripping from energy supplied by a capacitor charged from a low voltage ac source and controlled by relays. This is usually called "capacitor trip" (see Figure 2).

3) Tripping from energy supplied by current transformers connected directly to small trip solenoids *without* control by relays. Time delay may be provided by dash pots attached to plungers of solenoids. The dash pots may be hydraulic or air. Clockwork mechanisms are sometimes used (see Figure 3).

4) Tripping from energy supplied by current transformers controlled by circuit closing relays and reactors (see Figure 4).

5) Tripping from energy supplied by current transformers controlled by circuit opening relays (see Figure 5).

6) Tripping from energy supplied by low voltage ac source — usually used only for switching but occasionally controlled by ground relays. Three, four and five are usu-

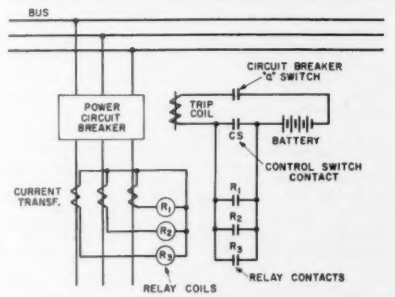


FIG. 1 D.C. TRIP WITH OVERCURRENT RELAYS

Fig. 1 — When current from current transformer exceeds relay setting, the relay starts to operate. After a time delay depending on value of current relay, the contact closes to energize the trip coil and trip breaker. More complex types of relays are often used with dc trip, but the plain over-current is shown here for simplicity. The control switch contact is operated manually for switching. * * * * *

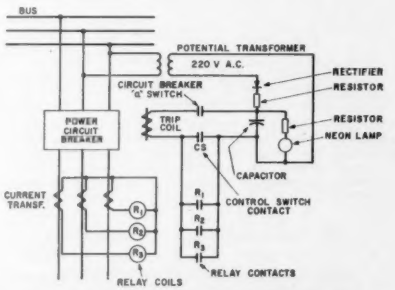


FIG. 2 CAPACITOR TRIP SHOWN WITH OVERCURRENT RELAYS (MORE COMPLEX TYPES OF RELAYS MAY BE USED)

Fig. 2 — Capacitor is maintained charged by energy from a potential transformer connected to source side of breaker. When over-current occurs, a relay contact closes to discharge the capacitor through trip coil and open breaker. Manual control switch, usually provided, also trips breaker by discharging capacitor through trip coil. Neon lamp indicates capacitor charged and ready to trip. * * * * * *

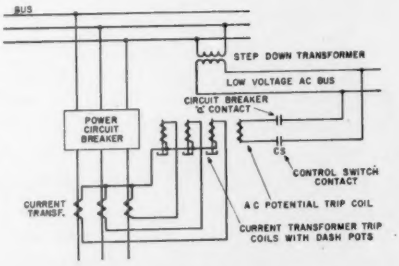


FIG. 3 CURRENT TRANSFORMER TRIP WITHOUT RELAYS

Fig. 3 — As shown, current transformers are directly connected to trip coils. When secondary current exceeds pick-up setting, plunger is drawn into coil to release latch and trip breaker. Plunger motion is restrained by dash pot for a short time depending on magnitude of current. The ac potential trip coil shown is provided in some cases for manual switching from a remote location. * * * * *

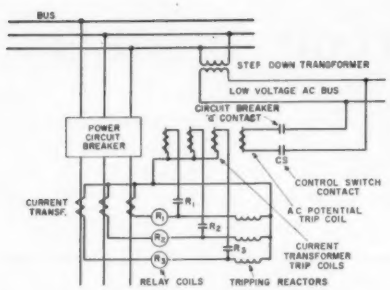


FIG. 4 CURRENT TRANSFORMER TRIP, WITH CIRCUIT CLOSING RELAYS AND TRIPPING REACTORS

Fig. 4 — During normal operation, secondary current from current transformer circulates through relay coils and reactors. When an overcurrent occurs, a relay operates to close its contact and transfer some of the current to trip coil to open breaker. Obviously, the impedance of reactor must be higher than that of the trip coil and the correct reactor must be selected to match the trip coil used. Separate sets of transformers may be and often are provided for relays and reactors to reduce burden on relaying transformer and improve accuracy of relay response. * * * * * * * *

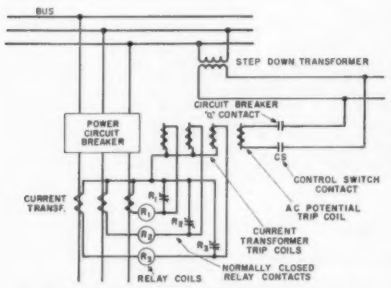


FIG. 5 CURRENT TRANSFORMER TRIP WITH CIRCUIT OPENING RELAYS

Fig. 5 — During normal operation, secondary current from current transformer circulates through the relay coil and its normally closed contact. When an overcurrent occurs, a relay operates to transfer current to trip coil to open breaker. * * * * * * * *

ally referred to as "current transformer trip" but can also be identified as "ac trip." Number six is customarily "ac potential trip."

* * *

Not all of the above types of trip are available in all sizes and types of breakers. Usual practice of the various power circuit breaker manufacturers differs a little but in general the following is customary.

* * *

For large outdoor oil circuit breakers (rated above 69 kv), only number one is available.

* * *

For intermediate voltage outdoor oil circuit breakers, rated 23 through 69 kv, numbers one and two are usually available although number one is preferred and customary. All types of trip are available for small outdoor breakers rated at 15 kv. The same is true for indoor oil breakers, rated 15 kv and below.

Numbers one and two are usually used for magnetic breakers rated 5 kv although all methods of trip are available. For larger breakers of this type, rated 15 kv, only numbers one and two are offered.

Application Determines Trip Method

Method of trip to be used depends on the application and each one should be considered individually. Sometimes the opinions of the user are the deciding factor where any one of several methods may be considered adequate. Among the factors which should be noted for each application are the location of the breaker with regard to the system; the size and type of breaker, whether it is a large station with many breakers or a single breaker in an unattended substation, or if it is an entrance breaker for an industrial plant.

* * *

In addition, there are the degree of accuracy and selectivity deemed essential, reliability required, and the cost considered justified. Of these, cost is perhaps most important, otherwise number one would always be used. Number one is regarded as the most reliable method and can provide the ultimate in accuracy, selectivity, and degree of protection if relays are correctly applied. It is also, however, often the most expensive, especially where only one or a very few breakers are installed.

* * *

In large stations with many breakers a control battery is provided for all control functions and all breakers are tripped by energy from this battery as a matter of course. In isolated locations with only one or a very few breakers, one of the other methods of trip from an ac source will often be entirely adequate. The relatively large cost of a storage battery, plus charge, installation, and maintenance will not be economically justified.

* * *

A few statistics indicating the consensus of opinion of a considerable number of users of circuit breakers may be of interest. These figures were compiled from a survey of a large number of breakers of all types shipped during 1956 and 1957. Although the relationship may have deviated a little since, there appears to be no important change:

A. Large outdoor breakers, rated above 69 kv — all number one.

B. Outdoor breakers, rated 23 through 69 kv, approximately 99 percent — number 1 and 1 percent number 2.

C. Small outdoor breakers, rated 15 kv — 65 percent were provided with number one, 25 percent with number two and 10 percent with numbers three, four or five.

D. Number one is used with about 94 percent of magnetic breakers and about 6 percent utilize number two. In addition some 2 percent to 3 percent of breakers rated 5 kv are provided with numbers three, four or five. This is less than 1 percent of the total number of magnetic breakers shipped.

E. On indoor oil breakers the approximate figures are number one — 55 percent, number 2 — 9 percent and three, four and five — 36 percent. The considerable use of three, four and five on these indoor breakers is due to the rather large number of small manually operated breakers, approximately 30 percent of the total. Many of these were furnished with number three, as has been the case for many years.

* * *

The above figures indicate that number one is the preferred method by far. This is to be expected as the dc source of tripping energy is entirely independent of the circuit controlled and protected by the breaker. Storage battery installations with associated charging equipment are highly reliable if well maintained and maintenance is simple and infrequent. About the only situations where one of the methods of tripping from an ac source appears to be considered preferable are single breakers in isolated locations where maintenance is difficult or in installations of one or a few small breakers where the cost of battery, charger, installation, and maintenance is a considerable part of the total.

Merits and Limitations of Units Described

Number one has no limitations provided the battery is properly maintained. It can be used with any type of relaying and is quite generally regarded as the most

(*Please turn to page* 1180)

Plastic Ventilating System on Wire Coating Line Replaces Wood to Advantage

Description of an acid fume resisting ventilating system in AS&W's Worcester Works.

Two years of continuous bombardment from muriatic and sulphuric acids have failed to affect the 150-foot inert plastic hoods and the three 80-foot plastic towers which vent the wire coating line at American Steel & Wire Division of U. S. Steel, Worcester, Mass.

* * *

Selected to replace wooden hoods which were never wholly satisfactory, the plastic hood and towers have required no maintenance, repair or downtime, according to **Peter C. Parolis,** engineer, who installed the coating line, and **Ernest H. Lucas,** general foreman in charge of operations. These revelations followed recent inspection of the entire ventilating system.

* * *

Up to 16 strands of wire travelling at a rate of up to 100 feet per minute through the heat treating furnace, muriatic acid pickling line, hot rinse, zinc coating and final rinse operate through this system 24 hours a day. Fumes are exhausted at the rate of 70,000 cubic feet per minute.

* * *

The ability of the plastic ventilating equipment to withstand such punishment without deterioration is attributed by Beetle Plastics of Crompton & Knowles, Fall River, Mass., who engineered and constructed it, to the reinforced fibreglass-impregnated plastic from which it was made.

* * *

Previously, wooden hoods had vented the old wire coating line at American Steel & Wire Division. They proved unsatisfactory because, in addition to constant maintenance which meant downtime, they wore out too quickly.

* * *

The time for modernization came in 1958. For many years American Steel & Wire, a Division of United States Steel, had been a foremost manufacturer of coated wire. In recent years the electronics, communications and petroleum industries, especially, had been making increasing demand on the plant for heavier coatings on wire and for more uniform deposits of the coating to meet stepped up requirements for many kinds of heavy cable protection.

* * *

This demand was met with the installation of the new, nearly 300-foot long galvanizing line in November, 1958. In addition to the ventilating system several innovations were introduced into the line which makes it unique in the industry and provides faster operation under absolute control throughout.

* * *

The ventilating system covers 150 feet of the coating operation extending from the entrance end of the pickling tanks to the exit end of the plating tanks. Over the various baths is suspended a long, dome shaped plastic hood which narrows directly over the baths to a 3½ inch slot divided in the center to draw fumes from both sides of the baths. This hood is exhausted by three plastic motor-powered fans which connect directly into the three 80-foot plastic towers. So complete is ventilation that workmen operating beside the tanks cannot inhale fumes, and dissipation of fumes from the 80-foot height protects the surrounding community.

* * *

The ventilating system was fabricated in sections from ¼ to ½ inch plastic formed by the "lay-up" system over carefully engineered wooden patterns. They were held to relatively close tolerance and are bolted together in such a way that any section can be removed for inspection.

* * *

The first section of hood is

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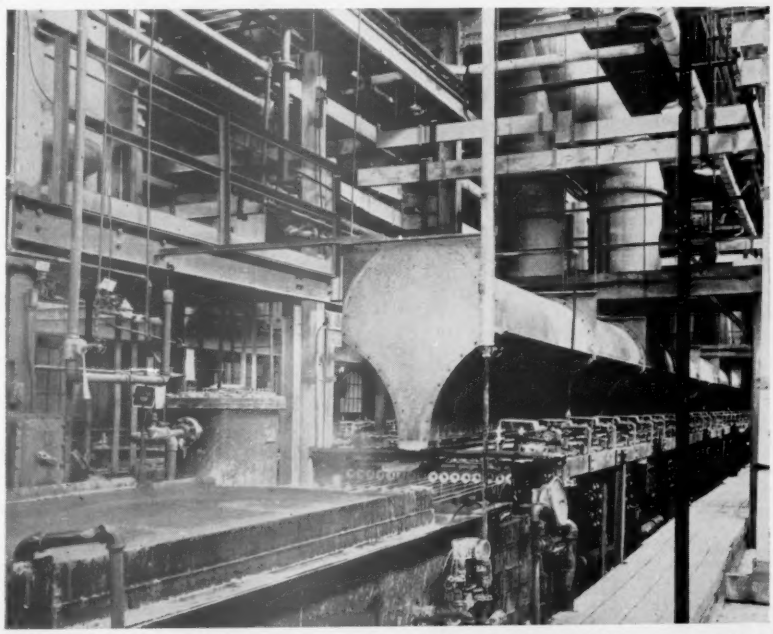

View of inert beetle plastic ventilating hoods and exhaust towers installed on wire coating line at U. S. Steel's Worcester Works of American Steel and Wire Division. * * *

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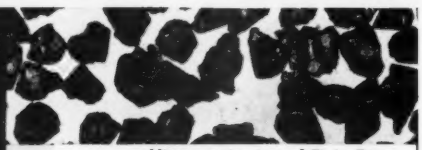

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Microscopic view of Elgin Diamond. Note the uniform size of all particles . . . it's the key to faster, finer polishing.

FORMULATION—Having exactly determined the compound you need, the next step is for Elgin laboratory technicians to prepare *your* Elgin Diamond Compound of the correct grade and concentration to assure optimum results. Here, Elgin skill and experience excel.

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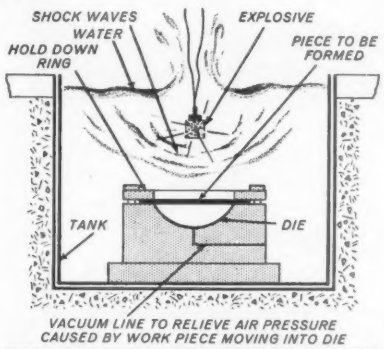
Wire Kinks

Explosive Forces in Metal Working

Mention the word explosion to most people and they think of destruction, death and disaster. Today, explosions are being put to constructive work for man in a growing number of dramatic new metalworking applications.

* * *

Explosive action is now used to shape and form steel and other metals; to drive rivets and studs; to weld metals; to harden metals, and to perform other jobs.



In riveting, explosive charges are useful for "blind" work, where tools cannot reach both sides of the rivet. Stud and rivet drivers, explosive powered, ram steel studs into concrete or send high alloy rivets into steel. Explosive welding, in the experimental stage, is working toward utilizing the explosive force of a single charge to bond metals together. Explosive release bolts are being used to jettison fuel tanks, rocket engines and other items after they have done their work and no longer need be carried in flight. Explosive hardening is now finding special uses which cannot be equaled by conventional methods.

* * *

Readers are invited to send us how-to-do-it items for this department. For each item received that is published we will pay contributors $10.00. Your cooperation will be appreciated by us and our many readers. May we hear from you?

Explosive forming works as follows: The metal to be formed is lowered into water and placed over the die and fastened into position. A carefully measured explosive charge is placed above the metal and fired by remote control.

* * *

The shock waves created by the explosion radiate and press the metal evenly against the die. A vacuum line in the die carries out the compressed air caused by the forming action. The whole process takes place in one fast step.

* * *

Dome-shaped parts 30 feet in diameter have been explosive-formed and work is being done to produce 40-foot diameter parts. Two-inch thick steel has been formed successfully, with fewer internal stresses than normally result from press forming.

* * *

Explosive welding utilizes a shock wave and a transmitting medium such as water—the same two elements used in explosive forming—to join two similar or dissimilar metals together. A charge is set off and the transmitting medium carries the shock wave instantly at great pressure and squeezes the metals into a bond, or weld. This type of welding can be done in hard-to-reach areas.

* * *

Explosive welding may be used in the fabrication of orbiting space stations.

* * *

Explosive hardening acts much faster than conventional methods and improves the quality of materials so treated, according to some experts. Manganese steels can be hardened by one quick explosion, so that tensile strength and hardness are both vastly improved.

* * *

These applications are probably only the beginning of a whole new approach to technology of metals. During the next few years, as these methods are refined, a long list of new uses for explosives in metalworking may be expected.

—From Steel Facts

Mechanical Descaling of Rod

QUESTION

Can mechanical descalers be used successfully on low and medium carbon rods? If there are any pitfalls, we would be interested to know what they are.

ANSWER

Descaling of rod by mechanical means is being done in many mills in this country although the process is more widely used in Europe with excellent results.

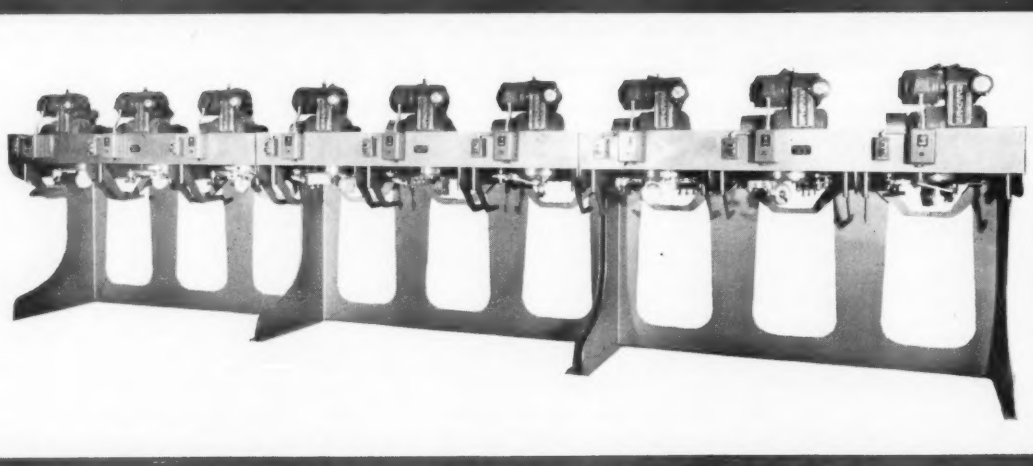
* * *

This descaling equipment has the advantage of being relatively simple and inexpensive. It usually is set up ahead of the rod breakdown machine, so that the power to pull the rod through the descaler is derived from the drawing machine, with the rod passing directly from the descaler into the drawing equipment.

* * *

The temperature at which the rod is rolled apparently has a very direct bearing on the degree of success with which the

From Start To Finish
A Continuous Line



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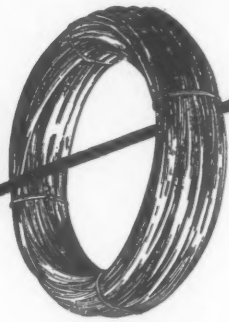
Wire Kinks



scale can be removed and many producers of rod are giving attention to this factor in the rolling process.

* * *

If the rod temperatures are too high, a harder and heavier scale is produced that is not always completely removed, due to the formation of the very hard oxide hematite (Fe_2O_3) and a large proportion of magnatite (Fe_2O_4).

* * *

The British Iron & Steel Research Association has conducted extensive studies of scale on low, medium and high carbon hot rolled rod having finishing temperatures of 750°, 850°, 950°, and 1050° C, and has concluded that efficient scale removal by mechanical descalers is considerably facilitated where the temperatures have been maintained on the low side.

* * *

The problem therefore very much is one of securing rod from a source that is aware of it and has taken measures to control the rolling temperatures with this cleaning method in mind.

* * *

When drawing mechanically descaled rod, the matter of lubricants is all-important. Most of the leading wire drawing lubricant manufacturers have developed special lubricants for this purpose and they should be used to assure good end results.

Salt Bath Annealing

QUESTION

What are the uses and characteristics of salt bath furnaces in the wire mill?

ANSWER

Salt bath furnaces have been used in wire mills and elsewhere in metals heat treating operations for 35 years or more.

* * *

They can be oil, gas or electrically heated, the last being the more common and considered the best method, as it permits the use of heavy gage metal in the pot and avoids the retarding effect of scale that will be formed when outer heating methods are employed, whereas pot cost is less with gas or oil heating, fuel costs run higher.

* * *

One of the great advantages resulting from the use of salt baths in annealing wire is the flexibility of the furnace and its adaptability to small batch annealing where small orders and quick deliveries are to be handled and made.

* * *

The furnaces can be used for low, medium and high carbon wire and some alloys. Salts of various kinds are available for different processes. For annealing sodium carbonate (one part by weight of potassium chloride and one part of soda ash) is commonly used. Normal operating temperatures of 1250° 1300°F controlled within a range of plus or minus 5 degrees are readily maintained for low carbon wire, with time cycles of 20 to 50 minutes, depending on the wire gage and weight of the charge.

* * *

While excellent for the process annealing of small batches salt bath furnaces can be used for large regular production operations by using larger units, which can take wire coils of 1500 or 50 pounds.

* * *

This method of heat treating, being inherently free from any need for atmospheric protection, assures freedom from pitting and scaling on either ferrous or nonferrous metals.

* * *

In addition to annealing, salt baths may be employed for a large variety of heat treating operations such as patenting, hardening without decarburization, carburizing, brazing, austempering, martempering, tempering, cyaniding, cleaning, descaling and other heat treatments. Temperatures of from 350°F to 2400°F are readily secured and maintained.

Packaging Steel Wire

QUESTION

Can you give us information on the various methods used in packaging wire for shipment to protect the wire from corrosion in storage and transit?

ANSWER

Any carbon steel surface tends to oxidize or rust unless it is protected from the atmosphere.

* * *

Much coarse bright basic wire is shipped in box cars and rusting does not occur unless the box car roof or other unusual factor allows moisture to get into the car. Such wire usually has a slight rust inhibiting property from the residual lubricant

(*Please turn to page* 1192)

THE BIG PLUS

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WRITE OR PHONE FOR RATES AND DATA

OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION

WIRE AND WIRE PRODUCTS

453 MAIN STREET PHONE DA 3-0482 STAMFORD, CONNECTICUT

Improved Method of Production for Flattened Strand Ropes

by Leo Walter
Consulting Engineer
Painswick, England

A new closing machine is described by the author that has been developed by Larmuth & Bulmer Limited, Salford, England, to whom the author is indebted for the illustrations and technical data.

While the Sun and Planet type of machine still maintains its place within the range of rope-making machinery, many wire rope manufacturers would prefer to eliminate its use as far as possible. The limiting factors of its speed and excessive down time, governed by the nature of its construction, made improvement of operations highly desirable. One such operation which has hitherto been restricted to slow-running Planetary machines is the closing of flattened strand ropes. Normally, the high speed tubular strander is employed for making certain strands for flattened strand ropes. A British machinery firm now has developed a high speed tubular machine that is able to take the place of the Planetary type machine for the final closing operation. It is claimed that this new machine not only produces wire ropes at a greater linear speed, but also provides other time-saving advantages.

* * *

As a result of research and development efforts the wire rope industry has, for the first time, high speed tubular machines available which not only will close a wide range of round ropes, but also will produce at high speed flattened strand ropes equal to, if not of better quality, than those produced by slow-running Planetary machines. Before describing the improved method of closing flattened strand ropes, it may assist in clarifying the problem to consider briefly the form inherent in the production of strand used in the finished flattened strand rope according to conventional practice.

Strand Production

The strands generally consist of round wires arranged in triangular formation around a core wire of solid triangle, or of round wires stranded to triangular shape. This strand can be produced on high speed tubular stranders, as shown on Fig. 1. The core wire is located in a bobbin at the rear end of the machine, and is fed into and along the tube, to enter the centre of the lay-plate at the front end of the machine. At the front end, a "Tee" mandrel is used, in place of the normal fixed die box. The "Tee" mandrel consists of adjustable pressure rollers, grooved to suit the shape of strand under construction, as shown on Fig. 2.

* * *

The core bobbin and the "Tee" mandrel are suitably connected so as to be driven synchronously. The rotating speed of both the core wire and the strand-forming "Tee" mandrel is arranged at a speed lower than that of the tubular section carrying the wires which surround the centre core. This speed differential results in a strand shape formed by the "Tee" mandrel rollers, but having a helical twist termed a "flat lay", (See Fig. 3). The flattened strand then is wound on bobbins, for loading into the closing machine.

* * *

The production of round strand ropes presents little difficulty to wire rope makers. With flattened strand ropes however, because of the "flat lay" formed when producing s strand, a great deal of attention is necessary when "marrying" the strands to form the finished rope. If it were possible to produce an exact theoretical "flat lay" strand, suitable for forming the finished wire rope, then the closing operation would be similar to that of rope production, presenting no special problem. However, experience shows that it is unlikely that strands with a "flat lay" will exactly conform to the closed rope requirements and, without some arrangement within the machine to adjust imperfections, a gradual "screwing up" of the strands would result during the closing operation.

A planetary machine used for closing flattened strand ropes is provided with an extra long front section, used to observe and control the behaviour of each strand. This type of Planetary machine is usually of a slow-running detorsion type, fitted with holding guide rollers, which control the strand, and with "butterflies" to

(*Please turn to page* 1178)

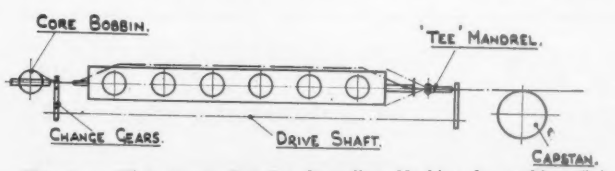


Fig. 1 — High Speed Tubular Stranding Machine for making flattened strand.

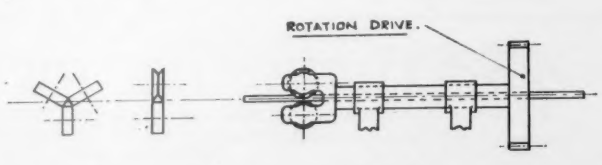
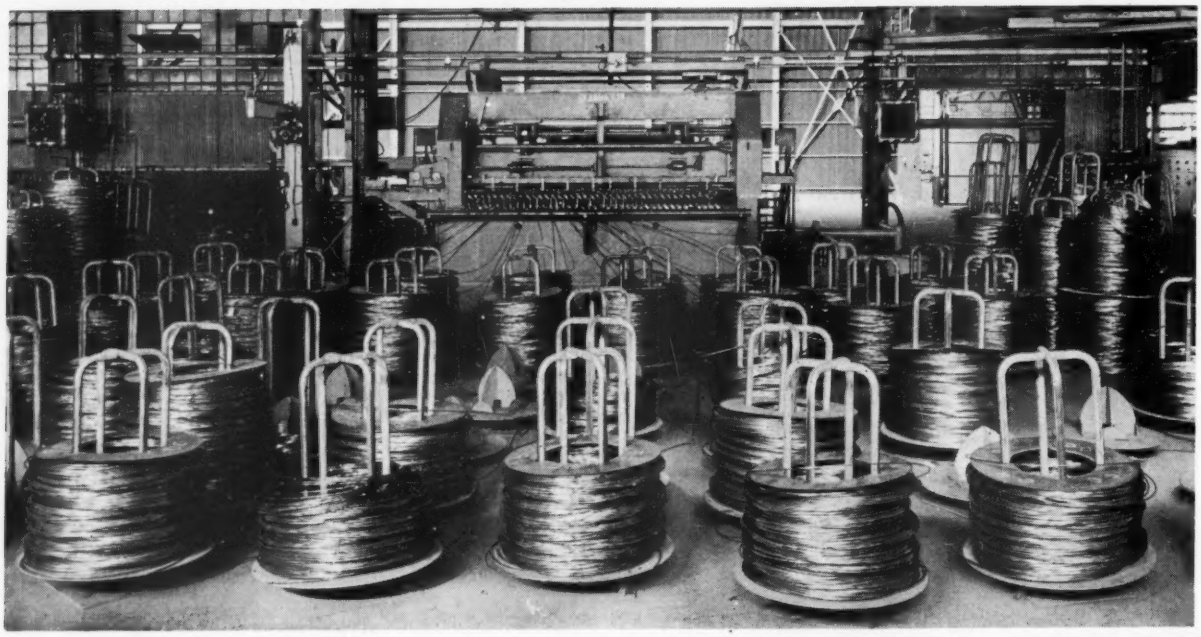


Fig. 2 — "Tee" Mandrel on the tubular strander.



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What we say about the cost-saving advantages of LPR's reflects not only our own experiences, but also the experiences reported by our LPR customers. For example:

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- **Man-hour costs trimmed 20% and more**
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Learn what LPR's can do for your Brite Wire operations. Call your nearest DSC customer "Rep" for the facts, or write Detroit Steel Corporation, Box 7508, Detroit 9, Mich.

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THE ANNUAL CONVENTION OF THE WIRE ASSOCIATION

FRENCH LICK-SHERATON HOTEL, FRENCH LICK, INDIANA

OCTOBER 23 to 26, 1961

The Wire Association's Headquarters in the Hotel will be open each evening from Sunday, October 22, except Wednesday night.
YOU ARE CORDIALLY INVITED TO CALL AND MEET OTHER WIRE INDUSTRY MEN

REGISTRATION FEES: MEMBERS — $15.00; GUESTS — $18.00; LADIES — $5.00. CHARGES FOR MEALS WILL BE INCLUDED IN THE HOTEL'S AMERICAN PLAN BILL. SHOW YOUR MEMBERSHIP CARD WHEN REGISTERING AND WEAR THE BADGE YOU WILL RECEIVE THROUGHOUT THE CONVENTION.

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Elizabeth, N. J.

Simultaneous Technical sessions will be held for each section or division. See program on following pages. All wire men are welcome to come to the convention and attend the sessions.

Technical papers will be preprinted in the October issue of Wire and Wire Products insofar as possible. Titles to papers accepted become the property of The Wire Association and are duly copyrighted at the time of publication. All papers presented by members are eligible for consideration for the Medal Awards and other awards made each year for outstanding excellence.

THE ANNUAL CONVENTION of
THE WIRE ASSOCIATION

October 23 to 26, 1961, French Lick-Sheraton Hotel, French Lick, Inc.

It is suggested that all persons attending this Convention plan to arrive on Sunday, October 22, to register and attend the opening function on Sunday evening.

THE PROGRAM

Oct. 22, 2:00 P.M. — Registration
8:00 P.M. — The President's Reception

Oct. 23, 10:00 A.M. — Meeting of the Board of Directors
12:30 P.M. — Directors' Luncheon to Program Participants
2:00 P.M. — Joint Opening Session
Address of Welcome — Raymond S. Worth, President
Presentation of 25-Year Certificates to Members.
The Mordica Memorial Lecture: "How Soviet Wire Mills Compare with Those of the Rest of the World", by David M. Schmid, Pres., Techalloy Company, Rahns, Pa.

TECHNICAL SESSION

MODERATOR

John H. Corson, Mgr., Webb Wire Div., The Carpenter Steel Co., North Brunswick, N. J.

PAPER: "Continuous Conveyorized Loop Processing — A New Concept of Rod and Wire Handling" — by John Zouck, Gen. Mgr., Wirecrafters, Inc., Towson, Md.

PAPER: "Aluminum Conductors in India — A Decade of Experience", by V. G. G. Nayar, Gen. Mgr., and S. Peer Mohammed, The Aluminum Industries Ltd., Kundara, India.

4:30 P.M. — Annual Meeting of Members of The Wire Association

FERROUS TECHNICAL SESSION

October 24, 9:00 A.M.

MODERATOR

Fred A. Webber, Chief Met., Wickwire Spencer Steel Div. of The Colorado Fuel & Iron Corp., Buffalo, N. Y.

PAPER: "Effect of Drafting on Residual Surface Films in Wire Drawing" by Stanley Stalson, Res. Proj. Eng., American Steel & Wire Div., United States Steel Corp., Cleveland, Ohio.

PAPER: "The Processing of Steel into Cold Heading Wire", by Robert W. Davis, Supt., Bolt and Forged Products, Sheffield Div., Armco Steel Corp., Kansas City, Mo.

PAPER: "Controlling Quality of the Surface of Wire by Nondestructive Tests" by Henry G. Bogart, Branch Mgr., Magnaflux Corp., New York, N. Y.

PAPER: "Surface Defect Detection" by Harry F. Ammarell, Plt. Met. — Cold Drawing, and Richard B. Moyer, Nondestructive Testing Eng., The Carpenter Steel Co., Reading, Pa.

October 25, 9:00 A.M.

MODERATOR

Carleton W. Garrett, Met. Eng., Jones & Laughlin Steel Corp., Pittsburgh, Pa.

PAPER: "A New Approach to Die Shop Operations" by D. K. White, John A. Roebling's Sons Div., The Colorado Fuel & Iron Corp., Trenton, N. J.

PAPER: "Investigation of Variables in the Zinc Socketing of Wire Rope and Strand" by C. W. Smollinger, and J. B. Cornish, Research Engs., Bethlehem Steel Co., Bethlehem, Pa.

PAPER: "Wire Electrogalvanizing Process at the Steel Company of Canada Ltd. Dominion Works", by N. M. Switucha, Met., Metallurgical Div., The Steel Company of Canada Ltd., Montreal, Canada.

PAPER: "Production of Oil Tempered Steel Wire" by A. I. Cidonio, Industrial Chemist, The Colorado Fuel & Iron Corp., South San Francisco, Cal.

NON-FERROUS MECHANICAL WIRE TECHNICAL SESSION

October 24, 9:00 A.M.

MODERATOR

Earle W. Lovering, Met. Eng., Scovill Manufacturing Co., Waterbury, Conn.

PAPER: "The Properties of Copper — Titanium Alloys" — by William B. Steward, Jr. and James J. Powers, Jr., Research & Development Group, Frankford Arsenal, Philadelphia, Pa.

PAPER: "Manufacturing Copper Magnet Wire for Distribution Transformers" — by William Zarbis, Westinghouse Manufacturing Co., Athens, Ga.

PAPER: "The No. 7 Properzi Mill" by James B. Russell, Chief Met., Nichols Wire & Aluminum Co., Davenport, Iowa.

PAPER: "The Production of Copper Wire via Copper Powder" — by Jack F. Whitaker, Pres., Whitaker Cable Corp., North Kansas City, Mo.

ELECTRIC WIRE AND CABLE TECHNICAL SESSION

October 24, 9:00 A.M.

MODERATOR

Michael M. Suba, Mgr., Extrusion Markets, Union Carbide Plastics Co., New York, N. Y.

PAPER: "Some Aspects of the Compatibility of Various Electrical Insulating Materials" by J. E. Sloat, Prod. Mgr., F. Frank Markel & Sons, Norristown, Pa.

PAPER: "Insulating Wire and Cable with Silicone Rubber" — by Donald R. Say, Dow Corning Corp., Midland, Mich.

PAPER: "What's Behind Underwriters' Requests for Insulated Wire and Cable" — by H. E. Collins, Service Engineer, Approvals Laboratory, Underwriters' Laboratories, Inc., New York, N. Y.

PAPER: "Wire Coating with Polyethylene Resins: Improvement in Extrudate Quality by Using Sensitive Instrumentation" — by F. H. Skewis, Polychemicals Dept., Technical Services Laboratory, E. I. du Pont de Nemours & Co., Wilmington, Del.

COMBINED MECHANICAL WIRE AND ELECTRIC WIRE & CABLE TECHNICAL SESSION

October 25, 9:00 A.M.

MODERATOR

J. K. Gillett, Pres., Industrial Equipment Co., Englewood, N. J.

PAPER: "Semiconductive Compounds for Wire and Cable Extrusion — by A. E. Tarbox, Development Associate, Union Carbide Plastics Co., Bound Brook, N. J.

PAPER: "Production of Copper Rod" — Author to be announced.

PAPER: "Low Stress Elongation (LSE) Testing of Copper Wire" — by Matti J. Saarivirta, Research Supervisor, AMCO Research & Development, Inc., Sub. of American Metal Climax, Inc., Carteret, N. J.

PAPER: "The Place of Polyethylene as a Wire and Cable Insulation" — by J. C. Norton, Corporation Consultant for Electrical Engineering, Union Carbide Olefins Co., South Charleston, West Va.

SCHEDULED ACTIVITIES OTHER THAN TECHNICAL SESSIONS
ANNUAL CONVENTION OF THE WIRE ASSOCIATION

SUNDAY, OCTOBER 22

8:00 P.M. — The President's Reception.

MONDAY, OCTOBER, 23

10:00 A.M. — Meeting of the Board of Directors.
12:30 P.M. — Directors' Luncheon for Program Participants.
4:30 P.M. — Annual Meeting of Members of The Wire Association.
6:00-7:00 P.M. — Hospitality Hour — Courtesy of Suppliers.

TUESDAY, OCTOBER 24

1:30 P.M. — Meeting of the Electric Wire & Cable Management Committee.
8:00 P.M. — Evening at the Races. Movies of 8 real races. "Betting" on the ponies (no money involved), with prizes to those who pick the most winners.

WEDNESDAY, OCTOBER 25

6:00-7:00 P.M. — Hospitality Hour on Pay-as-You-Go basis.
7:00 P.M. — The Annual Dinner
Awards for outstanding 1960 papers presented to:

FERROUS DIVISION

Medal Award to *Gilbert D. Dill,* Consultant on Blast Cleaning and Materials Handling, Mishawaka, Ind., for his paper: "An Economic Analysis of Acid Cleaning vs. Multiple Strand Blast Cleaning of Wire Rod."

Certificate of Honorable Mention to *Kenneth P. Brown,* Commodity Specialist, Pacific Metals Co., Ltd., for his paper: "The New Nickel Alloys in Wire for Special Applications."

NON-FERROUS DIVISION

Medal Award to *Robert C. Lawrence, Jr.,* Sales Representative, Chemical Products Corp., East Providence, R. I., for his paper: "Vinyl Plastisol — A Versatile Material for Insulating Wire and Encapsulating Wire Harness Constructions."

Certificate of Honorable Mention to *David Barr,* Plant Engineer, National Electric Div., H. K. Porter Co., for his paper: "Installation of a Semi-Automated TW Wire Extrusion, Coiling and Boxing Facility in a Medium Sized Wire Plant."

After Dinner Speaker: Herbert Philbrick — American Citizen, "Communist" and Counterspy — who will talk on his experiences as an American Intelligence Agent in exposing Communist activities for the F.B.I.

On the afternoons open for recreational pursuits, Tuesday and Wednesday, golf, skeet shooting, swimming (in heated pool) and many other activities offer opportunity for each one to indulge his favorite pastime.

LADIES ENTERTAINMENT: A special program for the ladies has been arranged. Ladies are requested to register and secure tickets and badges. They are invited to attend the Hospitality Hours, the "Races" and the Dinner. Mrs. John Sanderson will serve as Chairman of Ladies Activities.

All meals at the hotel are included in the American Plan charges for rooms and meals, to which the hotel will add 15% to provide for gratuities.

MEMBERS AND GUESTS WILL RECEIVE BADGES UPON REGISTERING. PLEASE WEAR THEM THROUGHOUT THE CONVENTION FOR IDENTIFICATION.

S.P.I. Holds 9th National Plastics Exposition

The Society of the Plastics Industry held its Ninth National Plastics Exposition at the Coliseum in New York City, during the week of June 5th.

* * *

This giant show was formally opened at one o'clock to reveal three floors of exhibits by plastic manufacturers and of machinery for processing plastics, such as extruding equipment and blenders.

* * *

In the opening ceremonies, a high-light was the address by **Dr. Hugh L. Dryden,** Deputy Director of the National Aeronautics & Space Administration, who hailed the critical role of plastics in the Space Age. At the conclusion of his talk, a pre-recorded message from **William T. Cruse,** Executive Vice-President of the Society was heard. This had been relayed to Echo I on May 15th and received and recorded by the Bell Telephone Laboratories at Holmdel, N. J.

Ceramic Insulated Thermocouple Wire

A highly versatile, ceramic-insulated, metal-sheathed, and spectrochemically clean thermocouple material designated "Tempak" has been developed by **Temptron, Inc.,** 7030 Darby Ave., Reseda, Calif., specialist in the field of temperature measurement. The new product is its own insulator and conduit provides maximum protection in conditions where corrosion, high pressure, severe vibration and extreme temperatures are present.

* * *

Tempak is manufactured for ordinary electrical leads, with single or multiple conductors, and is especially suited for use in corrosive media and gases such as liquid oxygen, hydrogen peroxide, kerosene, oil, alcohol and fatty acids.

* * *

Tempak will replace standard or conventional thermocouples in practically every field and application. It can be coiled or bent on a radius as small as its own diameter; it slips easily into inaccessible places; its compact ceramic insulation will not powder; and its accurately centered wires will not short-circuit.

Complete Line of High Temp Cables by Anaconda

A complete line of high temperature cables especially designed to solve hot spot problems where intense heat has previously critically curtailed the life of the cable is being produced by **Anaconda Wire & Cable Co.,** Hastings-on-Hudson, N. Y.

* * *

Designated as Hot Spot Securityflex, the line can be manufactured in all standard product ranges. All cords and cables, the company said, will be priced competitively with those not designed for high-ambient temperatures.

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All of the portable cords utilize a special butyl insulation with a

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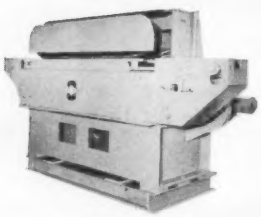
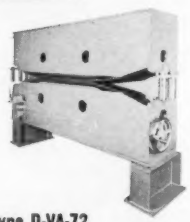
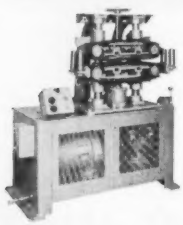


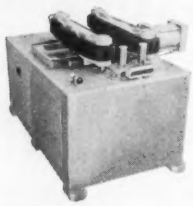
Type CV-DB-60
Maximum capacity — 6"
Maximum pull — 5000 Lbs.
Traction length — 50"
Maximum input — 50 H.P.
Maximum speed—750 F.P.M.



Type D-VA-72
Maximum capacity — 6"
Maximum pull — 5000 Lbs.
Traction length — 45"
Maximum input — 15 H.P.
Maximum speed—650 F.P.M.



Type BA
Maximum Capacity — 3"
Maximum pull — 700 Lbs.
Traction length — 20"
Maximum input — 3 H.P.
Maximum speed—500 F.P.M.



Type CHA
Maximum capacity — 6"
Maximum pull — 6000 Lbs.
Traction length — 30"
Maximum input — 15 H.P.
Maximum speed—500 F.P.M.

*Caterpuller features removable flat or contoured treads with choices of resiliency. Anti-friction tracks and air actuated heads assure non-destructive traction.

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British Associates	THE KEMSON ENGINEERING CO., LTD.	Blackburn, Lancs., England

butyl jacket. Control and power cables, in the stationary product line, use the special butyl insulation with an asbestos braid jacket.

Silicones for Electrical Insulation

A new eight-page two-color publication, "Silicones for Electrical Insulation", is available from the **Silicone Products Department** of **General Electric Co.,** Waterford, N. Y.

* * *

Designated CDS-288, the publication is complete with more than 20 photographs and charts providing valuable data and examples of silicones in use in a wide variety of electrical and electronic applications.

* * *

Included are sections on silicone varnishes for impregnating and protective coatings, clear and opaque potting and encapsulating materials, pressure sensitive adhesives, dielectric fluids, dielectric greases, wire and cable insulation and combination constructions of silicones with other materials. Aiso shown are some of the General Electric testing facilities which are available for development of new products and applications and the solution of complex customer problems.

* * *

The publication is available upon written request.

Spring Design

This new book, a practical treatise by **W. R. Berry,** Ph.D., M.Sc., M.I.mechE., F.R.I.C., F.I.M., Consulting Engineer and metallurgist, of Wetherby, Yorks., England, covers practically all categories of springs, and includes a chapter on material for coil springs — wires.

* * *

To avoid the time-consuming procedures of applying mathematical formulae in the calculation of spring designs, the author has converted the formulae into nomograms that can be substituted for the cumbersome calculations previously necessary.

* * *

Spring Design sells for $6.25

per copy, post free, and may be ordered from the publisher: **Emmott & Co., Ltd.**, 31 King Street West, Manchester 3, England.

New Metallizing Wire and Powders

The Wah Chang Corporation, 233 Broadway, New York 7, N.Y., has announced the availability of high purity molybdenum wire and a line of metal powders, oxides and carbides, for spray metallizing and plasma arc applications.

* * *

The unalloyed molybdenum wire is produced in diameters from 0.125″ to .057″, plus nothing, minus .002″. Tensile strength is 85,000-110,000 P.S.I.; moly content is 99.5% minimum. WCC moly spray wire fits all popular gun makes and models and is supplied in coils.

* * *

High purity tungsten, molybdenum, tantalum, columbium, hafnium and zirconium metal powders, carbides and oxides, round out the company's line of metallizing products.

* * *

Wholly American-owned, the Wah Chang Corporation is a fully integrated supplier and has been a major producer and fabricator of refractory metals for more than 41 years. The company maintains plants in Albany, Ore.; Fair Lawn, N. J.; Glen Cove, N. Y.; Huntsville, Ala.; and Texas City, Texas.

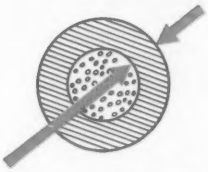
* * *

Further information on the company's metallizing products can be obtained from the company.

Deerskin Welding Gloves

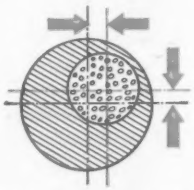
A larger, more comfortable welding glove, made of pearl flesh split, Brazilian Jack Deerskin, has been introduced by the Glove Division of the **Riegel Textile Corporation.** This leather is exceptionally soft, provides excellent wear and withstands heat well. The back of the hand is lined for added insulation and perspiration absorption, and the cuff is fully lined with light-weight suede to prevent chafing. The

CABLEMAKERS

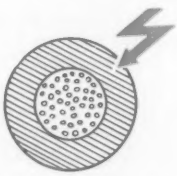


WALL THICKNESS
Monitoring or Control of Mean Wall Thickness

DIAMETER
Optical or Contact Monitoring or Control, Single or Dual Plane



ECCENTRICITY
Monitoring or Control of Coaxial and Multicore Cables and Jackets



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THE MOST ADVANCED–MOST COMPLETE–MOST VERSATILE

Addison instrumentation is used in over 200 Cable Plants throughout the world to obtain improvement in quality, increased rate of production, saving in labour and supervisory costs, and saving in raw materials. The equipments cover every aspect of cable manufacturing processes and the unitized construction affords exceptional versatility in building control systems to meet all requirements, at a very moderate cost.

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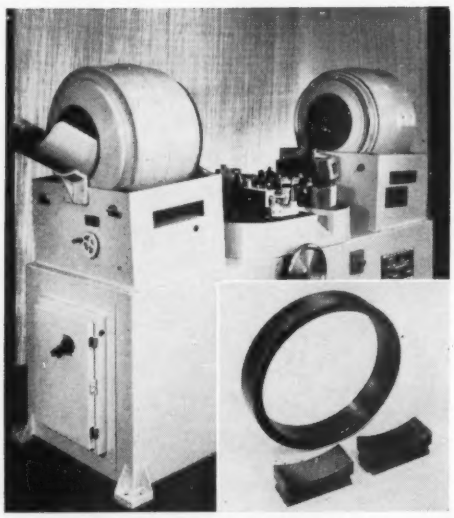
Planetary Thread Rolling Machine

Rolls Screws, Bolts and Nails

400 TO 800 PIECES PER MINUTE

CAN CUT COSTS 65%
IMPROVES QUALITY
STEPS UP PRODUCTION

CUTS
COSTS...



Prutton Planetary Thread Rolling Machine
Model 125A-24

When you stop lost motion you start cutting costs. That is the basic idea behind Prutton's Planetary die system. This Model 125A-24 Prutton Thread Roller produces 400 to 800 threaded parts per minute—class 3 fit. It easily handles thread rolling; roll forming; knurling; serrating and necking. It rolls diameters .090 to 5/16" and can apply threads up to 3 inches long. Special models handle blanks up to 8 inches long.

Die life of five million pieces is not unusual because the Prutton Planetary Die has 36 inches of working surface. Conventional machines would require a five foot stroke to handle equivalent die area. But, the Prutton Planetary Die measures only 12 inches across and the entire machine occupies a mere 18 square feet of floor space. One Prutton can replace four or more conventional machines.

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Leader in Planetary Thread Rolling Machines

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glove has an extra-long 6½ inch cuff for arm protection. In addition, another patch on the palm of the glove gives added protection to the thumb seam. Other seams are fully welted where metal flow is heaviest.

* * *

According to Riegel, both the leather and construction features make this one of the most comfortable and long-wearing gloves a welder can wear.

* * *

For further information, write Riegel Textile Corp., Conover, N. C.

List of ASTM Publications

The American Society for Testing Materials announces the availability of a 62-page list of publications. Published in April of this year, this catalog describes the Symposiums, Manuals, Special Publications, Indexes, Standards, Charts, Reference Photographs and Reports published by the Society. More than 300 items are fully described, 40 of which are new and not previously listed.

* * *

The publications cover all phases of materials and their evaluations and are arranged by titles and subject. The list of publications may be obtained without charge from the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

Miniaturized Wire Terminating

Terminating fine-gauge wire leads with miniaturized lugs by resistant welding is a custom-processing service by **Manger Electric Company, Inc.** Specially designed automatic machinery end-strips any stranded or solid wire, as fine as AWG No. 30, with most types of extruded insulation, and then stamped-out terminals are resistant welded.

* * *

As an illustration, a miniaturized flag terminal with a butt only 1/32" wide attached to a 1/16" end-stripped AWG No. 30 wire by a combination of resistance welding and crimping, is possible.

* * *

For further information, write Manger Electric Co., Inc., Miller St., Stamford, Conn., or phone FIreside 8-7761.

Reduces Carbidemetal Price

Firth Sterling announces a reduction in carbide metal price and proportional reduction in prices of throw away inserts and single point tools. The new prices are incorporated in a new catalog, TTI-61, issued by Firth Sterling, effective June 1, 1961. The new catalog shows a complete line of tips, inserts, tools and toolholders, with specifications for each product and the sizes and grades stocked.

Marking Methods, Machines Described in New Brochure

The importance of legible, complete and low-cost marking, identifying, or decorating of products, packages and labels is the subject of a new six-page brochure published by **Markem Machine Company,** manufacturers of marking machines, specialty inks, type and marking supplies. Titled "Helping Your Product Speak For Itself", the brochure points out that attracting a prospect's eye doesn't necessarily mean the sale of a product; buyers often have to know what the product is, who made it, what it is used for, how to install and maintain it, and other vital information. This data must sometimes be printed directly on the product as well as on its package. How effectively a product "speaks for itself" can mean how well it sells itself.

* * *

Copies of the brochure are available from Markem Machine Company, 178 Congress Street, Keene, N. H.

Engineering Manual on Dillon Remote-Indicating Systems

This new manual illustrates the many uses of remote indicating load cell systems throughout industry, suggests ideas for new applications not already commonly known. Compares the new Dillon differential transformer principle with conventional tube and

smooth spool-out at high speed!

Apco Mossberg reels, spools and bobbins are designed and manufactured to precise tolerances; run on true arbor for smooth spool-out even at high speeds.

An all steel construction assures rugged dependability, reduces downtime and machine maintenance to a minimum.

With over 50 years of reel experience in back of them, Apco Mossberg can give you the very best in reels, spools and bobbins. For more information, write, wire or call collect.

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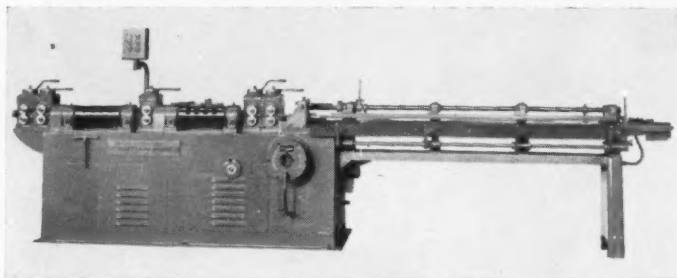
GEO. C. PATTERSON
HI-SPEED
AUTOMATIC WIRE STRAIGHTENING & CUT-OFF MACHINES

NEW from PATTERSON



The Dual Arbor Wire Straightening and Cut-off machine increases production up to 100%.
Model #112A-TC (Transit-Cut) for 6-ft lengths, shown.

This machine is especially good news to the spring industry and other fabricators of Hi-Carbon Wire where forming is involved in subsequent operations.

Two straightening arbors revolving in opposite directions minimize the severe twist encountered from single arbor machines.

Ten driven feed rollers make possible the use of coils weighing up to 2,000 lbs., coupled with independent variable feed, independent fly-shear variable head speed, air clutch, air brake and solenoid clutch operation spells versatility and flexibility.

This machine also available with one straightening arbor and three sets of powered feed rolls for processing wire up to ¼" diameter.

Call or write for information on any straightening requirement from .015 thru 1.00 dia.

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circuitry designs. Covers 33 capacities from 0-100 lbs. through 0-1,000,000 lbs. Compression, tensile and push-pull models. Provides full scientific data for in-plant engineering of complete projects.

* * *

Write for Bulletin R-2 to **W. C. Dillon & Co., Inc.,** 14620 Keswick St., Van Nuys, Calif.

General Cable Orders New Cable Sheath Machine

Columbia Technical Corporation, exclusive United States sales representative for **Hackethal Wire & Cable Co.,** of Hannover, West Germany, has completed a licensing agreement with **General Cable Company**, of New York, for the manufacture of lightweight corrugated metal sheath cables utilizing an entirely new, low cost process, it was announced by **Dr. Nikit Ordjanian,** president of Columbia Technical.

* * *

The new process, employing a special new cable sheathing machine developed by Hackethal, permits thin strips (0.12" to 0.20") of metal tape (steel, copper, aluminum and other lightweight metals and alloys) to be placed around the cable core which is then longtudinally welded and corrugated in one continuous operation.

* * *

The metallic sheath cables thus produced are lighter, mechanically stronger, more flexible, and less expensive than cables manufactured by the traditional extruded lead jacket-metal pipe method. In addition, the new process cable is a closed system which is completely impervious to fluids and whose pliability is limited only by the pliability of the cable it contains.

1960 Annual Report of BISRA

The British Iron & Steel Research Association, 11 Park Lane, London, W.1, England, has issued its 1960 Annual Report, in which are covered many phases of iron and steel making, including basic

steel processes, sheet and strip, rod and bar rolling, wire drawing, metallurgy, research, etc.

* * *

These primarily are references to new developments that have been achieved or are in the process of study. Under the caption "Wire Drawing", the report comments as follows:

> **"The new design of wire-drawing capstan, which has a very high heat-transfer rate because its narrow annular gap promotes turbulence in the cooling water, has been pilot-scale tested on the BISRA high-speed wire-drawing machine. The tests have shown that the improvements in drawing speed possible with the capstan are particularly marked when drawing larger-gauge wires. While the precise figures obtained in any mill will depend on the particular conditions there, an increase of 45 per cent appears possible with 0.14-in. wire and of about 20 per cent with thinner 0.07-in. wire. Two machine manufacturers have decided to adopt this design of capstan, and trials of the first commercial machine should be possible in 1961.**
>
> **'Weld failures in high-carbon steel wire, during drawing, are a major trouble and work has therefore been carried out to determine the conditions for welding and subsequent heat treatment necessary to prevent failure. It has been shown that during welding of the more rigid, larger gauge, wire the main problem is end preparation and alignment. With the thinner gauges, the difficulty of controlling the cooling rate results in the formation of a low strength, fine-grained band on either side of the weld, and a low temperature heat-treatment cycle has been recommended to overcome this. Automatic control of these post-welding treatments on welding machines would greatly improve the consistency of welds produced and a survey of existing machines has been made with suggestions for improving their performance.**
>
> **"Work has begun on a study of the factors affecting the loss of ductility of high-carbon steel wire drawn at high speeds. Both ageing and residual surface stress effects have been shown to be relevant.**
>
> **"Existing methods for the continuous measurement of wire diameter have been surveyed to determine the scope for their application on high-speed machines. The optical and contact devices developed for controlling the coating thickness of insulated cables have sufficient accuracy and reliability to justify their use for this purpose."**

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For Fungus Resistance, Specify

TEXTILENE TWI-TAR

Offering great durability along with light weight, Textilene Twi-Tar is successfully used for buried communication cable (bedding and overall serving), expanded ACSR cable (expander between core and conductors), stationary power cable and portable cables.

Twitchell's superior Textilene line also includes: Moisture-resistant fillers — *Twi-Flex* and *Twi-Wax*. Used for non-metallic sheathed cable, maritime shipboard cable, varnished cambric cable.

Soft, dry fillers — *Twi-Port* and *Glascor** (Fiberglas-centered for high tensile strength without added bulk). Used for control, power, appliance, coaxial and communications cables, and all types of portable and flexible cords.

*Patent Applied For

For Every Wire and Cable Application
Twitchell's TEXTILENE Fillers Fill The Bill

Quality-controlled materials that are dependably uniform . . . in standard forms, or customized to special needs.

Assured supply from a reliable domestic source . . . always available in economical and convenient packaging.

Initial low cost with savings added by production efficiency . . . flexible, ready-to-use fillers that fit all equipment, handle and form easily, always maintain desired shape.

Proved performance as components of cables and wires that meet government specifications . . . stability shown by trouble-free installations in continuous service 20 years and longer.

FREE — SAMPLE SPOOLS of any type of Textilene filler to demonstrate the superiority of Twitchell materials in your operation—also technical counsel without cost or obligation. Just tell Twitchell your end-use requirements. *Write, wire, or phone today:*

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Outstanding Personalities of the Wire Industry

Driver-Harris Names V.P.-Sales

Election of **W. Paul Smith Jr.**, as vice president—sales of Driver-Harris Company, was announced by **Frank L. Driver III**, executive vice president of the company.

* * *

Mr. Smith entered the metals field with Electrical Alloys Co., which Driver-Harris purchased in 1923. He joined the Driver-Harris Company as an inspector of finished materials, later moving into the engineering section as plant engineering supervisor.

* * *

Assigned to the sales department in 1942, he was placed in charge of distributor sales three years later. In 1957, he was appointed assistant sales manager and elected assistant vice-president. In 1960 he became sales manager.

Steel Executive Named WRI President

D. W. Roberts, Manager of Sales, Construction Products, for the Kansas City (Mo.) plant of **Sheffield Division**, Armco Steel Corporation, has been named president of the **Wire Reinforcement Institute.** The association of steel welded wire fabric manufacturers elected him at its recent annual meeting here.

D. W. Roberts

* * *

Mr. Roberts, a graduate of Center College in Danville, Ky., served as a line officer during World War II, in command of an amphibious boat group. He has been with Sheffield for 23 years.

Keystone Steel Appointments

Creation of the post of Director, Wire Mill Development, and the promotion of **Jerry G. Weiss** to the new position is announced by **R. E. Sommer**, President and General Manager, **Keystone Steel & Wire Company**, Peoria, Ill.

* * *

His duties will include developing plans and making recommendations on changes in equipment, buildings and practices to further modernize the company's

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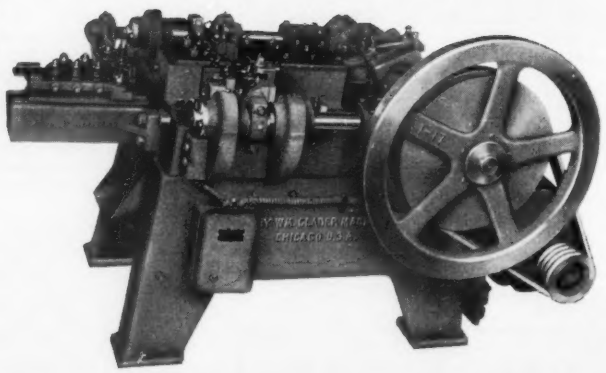

Wm. GLADER MACHINE WORKS 210 N. RACINE AVENUE CHICAGO 7, ILLINOIS

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Wire Mill operations. Included in the program are means to improve quality and lower production costs. Mr. Weiss will report to **W. B. Sommer,** Vice President, who will coordinate the overall Wire Mill program.

* * *

A Keystone employee since 1927, Weiss was Assistant Superintendent, Wire Mill, at the time of this promotion.

* * *

William A. Sommer replaces Mr. Weiss as Assistant Superintendent, Wire Mill. A graduate of the University of Illinois and the Keystone "Loop" Training Course, **W. A. Sommer** was General Foreman, Blooming and Billet Mills, at the time of this promotion.

Western Wire Appointments

The appointment of **George Hunsinger** to the post of Chief Engineer heads the list of promotions and assignments announced by **C. G. Gerlach,** President of **Western Insulated Wire Company,** Los Angeles, manufacturer of nationally-distributed Bronco portable electrical cords and cables.

* * *

"Mr. Hunsinger returns to Bronco after a five year hiatus," commented Mr. Gerlach, "and we look forward to the advancements in wire and cable design that his vigorous leadership presages." Mr. Hunsinger is a graduate of the University of Pittsburgh with a B. S. degree in chemical engineering. He brings to the position twenty-seven years of experience in the wire and cable business, all in executive engineering positions with National Electrical Products, Western Insulated Wire Co., and, most recently, with Roebling. He is a member of the American Institute of Electrical Engineers, American Society of Naval Engineers, and The Wire Association.

* * *

Jack Stumph has been appointed General Sales Manager. In recent years, until joining Western, Mr. Stumph headed his own firm of manufacturers representatives in Seattle. He handled, among other leading electrical products, Bronco wires and cables. Previously, he was associated with Graybar and the Wire and Cable Division of U.S. Rubber Co.

* * *

Several important promotions within the manufacturing organization were announced at the same time. **Hans Hacker** has been promoted to Factory Manager. He holds a degree in electrical engineering from the University of Southern California. During the past eleven years Mr. Hacker has served Western in the capacities of Design Engineer and Plant Superintendent. **Thomas Croston** has been promoted to the position of Assistant Plant Superintendent to aid Mr. Hacker. **Phillip Ramos** has been named Director of Purchasing and Production Control. He has been with Western Wire for fifteen years carrying a wide

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NON-CONTACT CONTINUOUS SPIRAL STRIPER!
For 100% Helical Striping
Horizontal Set-up Pat. Pending
Top Wire — 1, 2 or 3 helical stripes.
Bottom Wire — 1, 2 or 3 horizontal stripes with same or varied widths.
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Runs 1, 2 or 3 Colors Simultaneously!
Horizontal or Vertical Striping— Continuously!
Width of Stripe can be changed while running!
GEM GIVES YOU:
1. Years of research and know-how.
2. Most Modern Marking Machines, for insulated wire.
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range of responsibilities including those of General Foreman and Production Manager.

* * *

Two Bronco Regional Sales Managers have been appointed. **Thomas J. Walsh** is now Midwest Regional Manager with headquarters in Chicago at 15 N. Jefferson Street. **Frank J. Furnell** is now Pacific Coast Regional Manager with headquarters in the Western Insulated Wire Company Los Angeles factory at 2425 East 30th Street.

Named Plant Manager by Page

Ernest S. Wellhofer has been appointed plant manager of the Monessen, Pa., plant of **Page Steel and Wire Division** of American Chain & Cable Company, Inc.

* * *

Mr. Wellhofer joined the company's engineering staff at Wilkes-Barre, Pa., in December 1936. After serving as chief engineer for wire rope, he was appointed plant manager of the company's wire rope plant at Wilkes-Barre in 1955 which position he held until his recent appointment.

* * *

Joseph H. Ritts has been appointed plant manager of the Wilkes-Barre, Pa., plant to succeed Mr. Wellhofer. Mr. Ritts, who joined the company in 1942, has been assistant plant manager at Wilkes-Barre since December 1956. Prior to that he had been plant manager of the Pittston, Pa. plant.

What's your problem?
MAYBE WE CAN HELP!
We design and make many things besides spools. The carefully selected personnel in our Research, Development and Engineering Departments came from within the wire industry and know its problems.
Why not tap this experience for your own use?
Specialists in design and production of everything you need for Spooling, Re-Spooling, and processing all types of wire—ferrous and non-ferrous
Write or call us today
Acrometal makes a complete line of precision aluminum (and steel) spools for processing and shipping fine wire. Also disposable reels and packages up to 1,000 lbs. capacity.
ACROMETAL PRODUCTS, INC.
616 Fifth Street N., Minneapolis 1, Minn.

Union Carbide Plastic Appointments

Frank G. Bertics has been appointed as Assistant Regional Sales Manager in the Mid-Western Sales Region of **Union Carbide Plastics Company**, Division of Union Carbide Corporation.

* * *

In making the announcement, **H. L. Burpo**, Regional Sales Manager, stated that Mr. Bertics will supervise the sales activities for Bakelite Brand plastic materials used for flexible packaging, coatings, bonding, laminating, and sheeting. He will continue to be located in the Regional Sales Office at 230 North Michigan Ave., Chicago 1, Ill. (FInancial 6-3300).

* * *

James N. Barton has been assigned as a Technical Sales Representative in the Western Sales Region. He will be located in the Regional Sales Office at 2770 Leonis Boulevard, Los Angeles 58, California (LUdow 3-3061).

G.E. Elects New Officers

Ralph J. Cordiner, Chairman of the Board and chief executive officer of the **General Electric Company**, has announced the election by the Board of Directors of **Gerald L. Phillippe** as President and of **Cramer W. LaPierre** as Executive Vice President. Both men also were elected directors.

* * *

Mr. Phillippe had been comptroller and principal financial officer of the Company since 1953. Mr. LaPierre formerly was vice president and group executive in

charge of the Company's Electronic and Flight Systems Group.

* * *

The Company's services components, which include the functions of accounting, engineering, law, management consultation, manufacturing, marketing, relations, research and treasury, will report to Mr. Phillippe. Mr. LaPierre will direct his efforts to over-all forward planning for the Company, to special business situations, and to the Company's technical progress.

Shawinigan Appointments

The appointment of five persons to new posts within the research department of **Shawinigan Resins Corporation** was announced by **Dr. R. N. Crozier,** vice-president, research. * * *

Dr. James A. Snelgrove has been appointed research section leader in which post he will direct research activities in surface coatings and building products applications for all Shawinigan's products. Also appointed to applications research posts are **Bernard M. Brill,** group leader, building products, and **Peter M. Draghetti,** group leader, adhesives. * * *

In the exploratory research area, **Dr. Donald M. Gardner** has been appointed a group leader to direct the activities of the exploratory group in physical chemistry and polymerization methods. In product research, **Joseph G. Martins** has been appointed group leader and will direct the activities of the group responsible for research on Butvar, polyvinyl, butyral, and Formvar, polyvinyl formal. * * *

At the same time, **E. H. Finsilver,** General Sales Manager, also announced the appointment of **Irving Ash** as district manager of New Jersey and of **Bruce E. Porter** as district manager of the Cleveland territory.

* * *

David Cox has been made assistant manager of the product development department, **David R. Cahill, Stedman C. Herman** and **Robert W. Ross** have been made technical service managers for paper and textiles, adhesives, and electrical insulation, respectively.

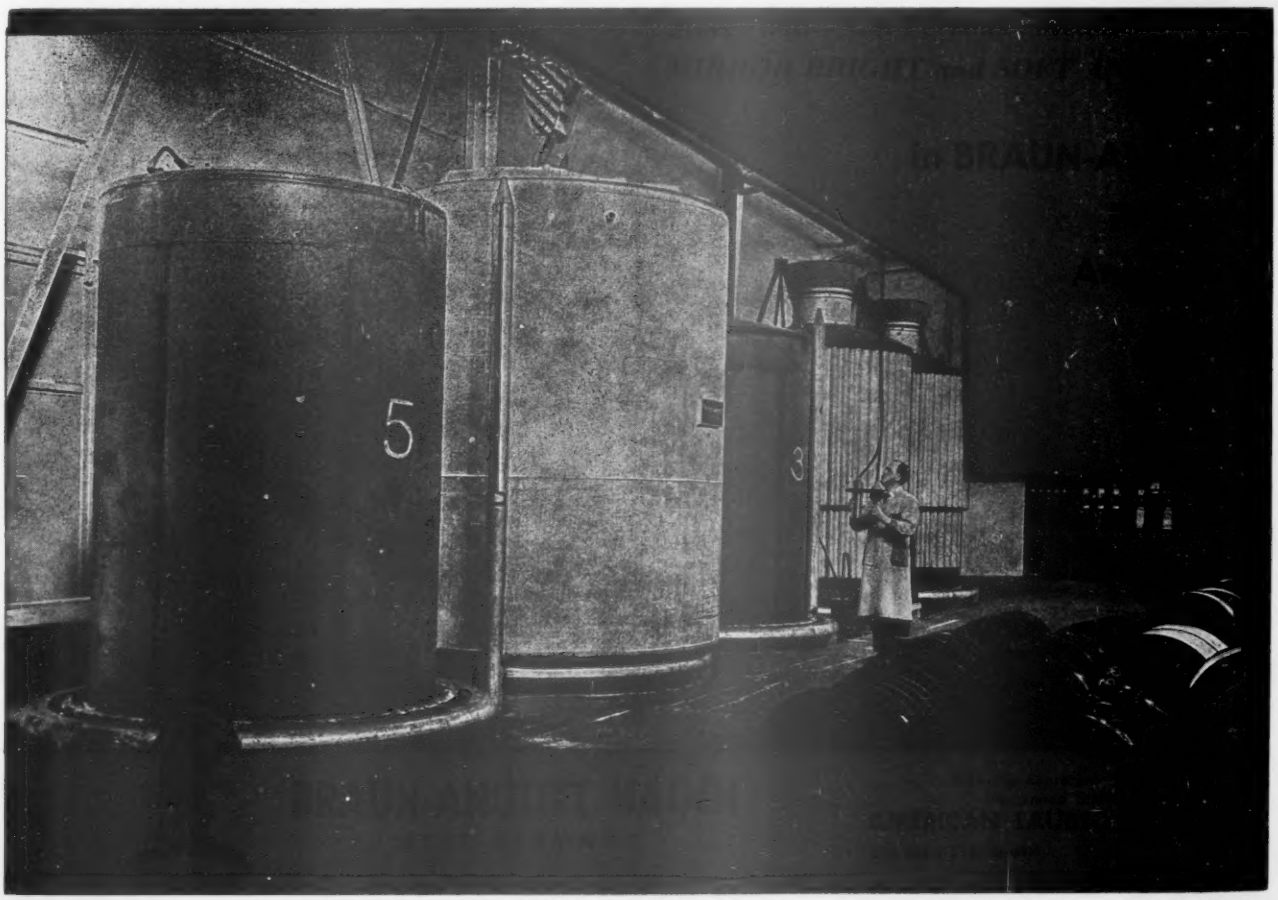
Appointed Metallurgist by CF&I

Robert William Freeman has been appointed wire metallurgist in **The Colorado Fuel and Iron Corporation's** Buffalo Plant wire mill. * * *

Prior to joining CF&I in April, 1961, Mr. Freeman served with the Technology Department of Union Carbide Metals Company in Niagara Falls, New York. He received a B.S. in metallurgical engineering from the University of Toronto.

Davis-Standard Names Canadian Rep.

John Kilgallon has been appointed Canadian field sales engineer for wire and cable and



plastic extruding machinery produced by **Davis-Standard,** division of Franklin Research and Development Corporation, Mystic, Conn.

* * *

For the past ten years Mr. Kilgallon has been project engineer for packaging film and plastics produced by duPont of Canada Limited, and has had considerable extrusion process experience.

* * *

He was graduated from St. Edwards College, Liverpool, England, and is an alumnus of the Government Technical Center, Manchester. During World War II, he served in the Special Service Commando Unit.

Union Carbide Announces New Vice-President; President of Division

R. K. Turner has been elected a vice-president of **Union Carbide Corporation** and **William B. Humes** appointed president of **Union Carbide Plastics Company,** division of the Corporation, it was announced by **Birny Mason, Jr.,** president of Union Carbide Corporation.

* * *

Mr. Turner has been with the Corporation since 1924 when he joined Union Carbide Chemicals Company at Clendenin, W. Va. He moved to the Plastics Company in 1952 as a vice-president and was appointed president of that division in 1957.

* * *

Mr. Humes joined Union Carbide in 1944 at Oak Ridge, Tenn. During the time he has been with the Corporation he was a vice-president of Union Carbide Canada Limited and director of technical planning for Union Carbide before he was appointed to his most recent position of vice-president of Union Carbide Plastics Company in 1959.

* * *

Mr. Turner attended Massachusetts Institute of Technology and received the degree of B. S. Ch. Eng. in 1923 and M. S. Ch. Eng. in 1924 from that institution. Mr. Humes is a graduate of Harvard University with the degree of B. S. in chemistry received in 1940.

Michigan Oven Appoints Representatives

LeRoy M. Gill, president of **Michigan Oven Company,** Detroit, has announced the appointment of **Edward R. Talone** and **Charles F. Dilcher** as national sales representatives.

* * *

Mr. Talone will handle all sales-engineering activities for the firm in the Baltimore, Maryland area and Mr. Dilcher will handle similar activities for the Atlanta, Georgia territory.

* * *

Mr. Talone holds a Mechanical Engineering degree from the University of Maryland and has over eleven years of experience in the industrial sales field with heavy emphasis on engineered oven systems, furnaces and related manufacturing equipment.

* * *

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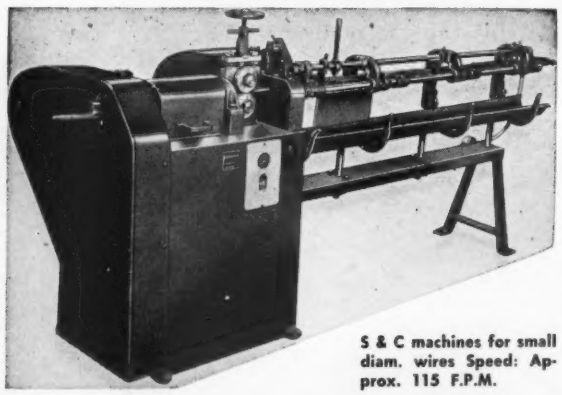
CHARACTERISTICS OF THE

WELLS STRAIGHTENER & CUTTER



S & C machines for small diam. wires Speed: Approx. 115 F.P.M.

The time-proven WELLS line combines maximum efficiency with that rugged dependability, for which WELLS S&C machines have become justly famous.

Built in several sizes to handle 2 to 18 ga. basic and high carbon wire.

FEATURES

The guide bar of these fine machines can be supplied for any cut lengths • The rotary flier runs on ball bearings for smoothness and long life • Cut-off is actuated by a solenoid for extreme accuracy of cut lengths • A two point cam construction provides a quick and positive return of the cut-off knife, eliminating the need for a clutch and dog • A counter is standard equipment.

A COMPLETE RANGE OF S & C MACHINES IS MADE BY WELLS FOR ALL SIZES OF WIRE. SEND FOR CATALOG ON THE COMPLETE LINE.

Frank L. Wells Company

Builders of Fine Wire Working Machinery

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Mr. Dilcher is a graduate of Purdue University with a degree in Mechanical Engineering. He was formerly with Sunbeam Equipment Corporation where he held the position of assistant chief engineer. He specialized in the engineering and development of industrial furnaces. He currently heads up Dilcher Engineering Company.

* * *

Michigan Oven Company manufactures and sells nationally a complete line of specially engineered oven systems as well as wire enameling equipment and complete finishing systems.

Union Carbide Plastics Assigns Technical Sales Representative

W. Kenneth Hill has been assigned as a Technical Sales Representative in the New England Sales Region of **Union Carbide Plastics Company,** Division of Union Carbide Corporation.

* * *

According to the announcement by **L. D. Burnett, Jr.,** Regional Sales Manager, Mr. Hill will be responsible for the sale of Bakelite Brand polyethylene, vinyl, phenolic, and styrene resins and compounds for molding and extrusion applications. He will be located in the Company's Boston District Sales Office at 300 First Ave, Needham Heights.

* * *

Mr. Hill was graduated from Virginia Polytechnic Institute with a Bachelor of Science degree in Mechanical Engineering. He joined Union Carbide Plastics Company in June, 1960.

Head Page Wire Sales

Ralph J. Teeple has been appointed sales manager of **Page Steel and Wire Division** according to an announcement by **Henry Ervin,** vice-president and director of sales of **American Chain & Cable Company, Inc.**

* * *

Mr. Teeple, who has been with the company's Page Steel & Wire Division since 1922, will make his headquarters at the Page plant in Monessen, Pa. He has served in New York as regional sales manager for Page's eastern district since 1939 and prior to that had been district sales manager at Atlanta.

Elgin Tranfers Field Personnel

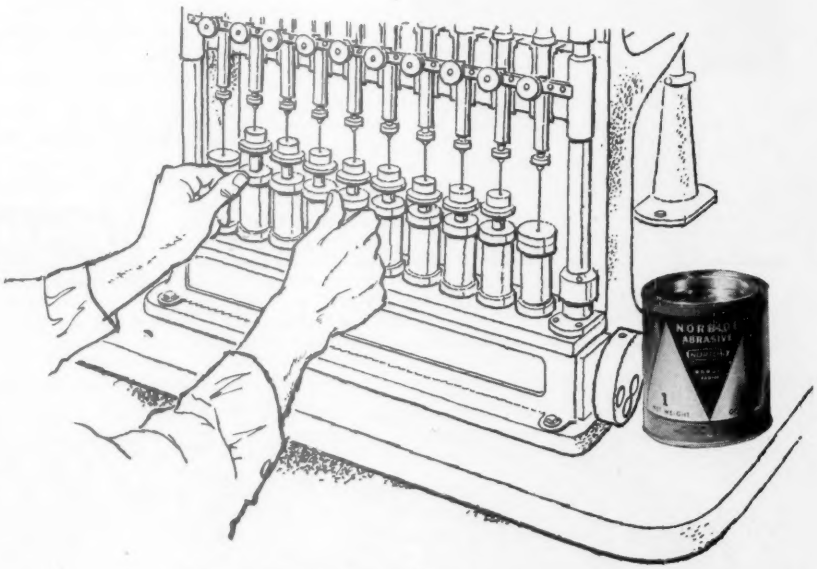
The Abrasives Division of the **Elgin National Watch Company** has announced the transfer of **Forrie Svendsen** from the New York State Area to the Indiana Territory.

* * *

Mr. Svendsen, who is now located in Indianapolis, will have charge of all direct and distributor sales and service of the diamond products of the Division in Indiana, Western Kentucky, Western Tennessee, and Alabama.

* * *

In addition to its full line of industrial diamond products, the Abrasives Division also manufactures a complete line of solid carbide rotary tools, and Elgiloy, a high temperature spring alloy.



NORBIDE Abrasive*
costs 300 times less than diamonds...
You can't beat this economy!

For high quality die refinishing — plus savings that are substantial and sure — here's something worth remembering:

Although NORBIDE *grain is next to diamonds and diamond dust for hardness this record-making abrasive costs only one three-hundredth as much as sized commercial diamonds!*

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*Trade-Mark Reg. U.S. Pat. Off. and Foreign Countries

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BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

Sjogren

AUTOMATIC SINGLE SPINDLE DIE SIZER

This automatic single spindle die sizer is designed for the wire mill requiring high speed production on a limited capacity basis. Typical production, per hour:

2 dies at .165"	8 dies at .082"
4 dies at .135"	10 dies at .072"
6 dies at .095"	15 dies at .062"

Rugged construction of this machine assures long life and trouble-free performance. If desired, a test run can be arranged, using your own dies, pins and compound.

Floor space:
24" x 19"
Mfg. under
Patent 2,391,983

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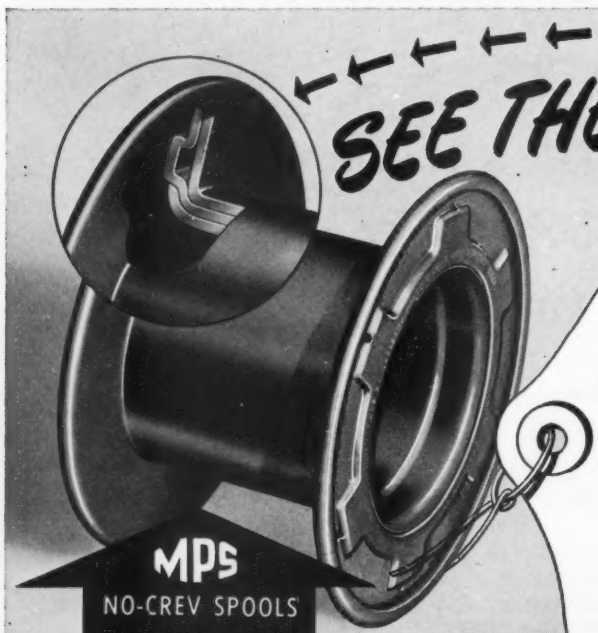

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#108

A Review of Recent Wire Patents

The data listed below is only a brief review of recent patents pertinent to the readers and subscribers of this publication.

Complete copies of these patents may be obtained by writing to the publisher of this magazine and remitting $1.00 for each copy desired. For orders received from outside the United States the cost will be $1.50 per copy.

For copies of patents that are out of print in the Patent Office, necessitating a reprint, the charge for U.S.A. orders is $1.50 and for foreign orders, $2.50 per copy.

No. 2,990,857, FENCE MAKING MACHINES, patented July 4, 1961 by Burke E. Porter, Grand Rapids, Mich., assignor to Habitant Shops, Inc., Bay City, Mich., a corporation of Michigan.

More specifically the machines are for wiring generally cylindrical fence pickets in side-by-side relations. There are 11 claims.

* * *

No. 2,990,959, COMBINATION GARMENT HANGER, patented July 4, 1961 by Andrew C. Larsen, 2438 Logan Ave. N., Minneapolis, Minn.

The hanger, constructed of lengths of wire is adapted to support coats and hats. Nine claims.

* * *

No. 2,991,021, STATOR WINDING MACHINE, patented July 4, 1961 by William James Batty, Ashford, England, assignor to The Sperry Gyroscope Company Limited, Brentford, Middlesex, England, a British company.

Stators with small diametered bores are said to be readily wound with little risk to damage to the walls of the bores.

* * *

No. 2,991,023, APPARATUS FOR HANDLING COILS OF STRIP MATERIAL, patented July 4, 1961, by Jeremiah W. O'Brien, Pittsburgh, Pa., assignor to United Engineering and Foundry Company, Pittsburgh, Pa., a corporation of Pennsylvania.

Apparatus is disclosed for embracing a coil of strip material to prevent the wraps of coil from springing outward includes a pair of arcuate lever arms operatively arranged adjacent a frame, a flexible belt secured at its ends to the outer free end of each secured at its ends to the outer free end of each arm and passing from one to the other as a chord of the arc defined by each arm, yieldable means intermediate the arms in engagement with and adapted to maintain the belt taut, means for pivoting the arms to maintain the belt taut, means for pivoting the arms toward one another and above the frame thereby to cause the belt to contact and embrace the coil about a substantial area of its periphery. Nine claims.

* * *

No. 2,991,328, MULTICONDUCTOR CABLE, patented July 4, 1961 by Norman R. Lay, Arlington, Tex., assignor to Chance Vought Corporation, a corporation of Delaware.

There are fourteen claims to this patent for a rigid multiconductor cable which is preshaped to conform to surfaces against or near to which it is to be mounted, and which cable is said to be substantially non-resonant to mechanical vibrations and to heat and abrasion.

* * *

No. 2,991,919, STEPPED GARMENT HANGER, patented July 11, 1961 by Jack Morris Zuckerman, Bronx, N. Y. (94-25 57th Ave., Elmhurst, N. Y.)

The hanger is constricted of a single length of resilient wire.

* * *

No. 2,992,469, FOURDRINIER WIRE CLOTH, patented July 18, 1961 by Alfred G. Hose, Cleveland, Laurence D. Kunsman, Willoughby Lake, and George P. Wennes, Lyndhurst, Ohio, assignors to The Lindsay Wire Weaving Company, Cleveland, Ohio, a corporation of Ohio.

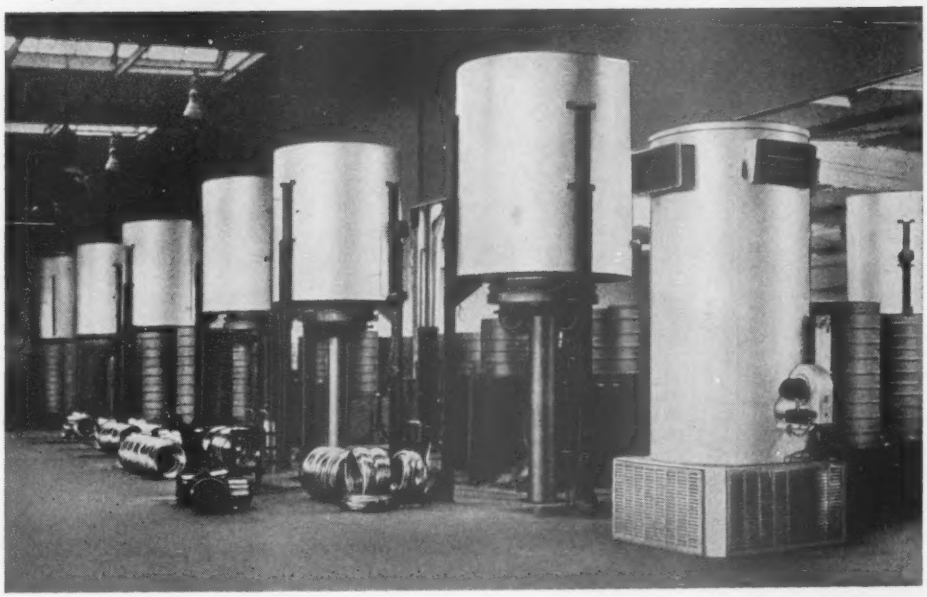
A method is disclosed comprising coating a phosphor bronze warp wire having a diameter of about 0.0070″ to 0.0105″ with a water insoluble non-metallic film-forming material to provide a solid coating adding no more than 0.0005″ plus or minus (0.0001″ to 0.0002″) to the wire diameter, coating an aluminum alloy shute wire having a diameter of from 0.008″ to 0.0120″ with a water insoluble non-metallic film-forming material to provide a solid coating adding no more than 0.0005″ plus or minus (0.0001″ to 0.0002″) to the wire diameter and weaving the coated wires to form a Fourdrinier wire cloth. Fourteen claims.

* * *

No. 2,992,792, WIRE-UNWINDING DEVICE SUITED MORE PARTICULARLY

(*Please turn to page* 1192)

Now also for Stainless and Chrome-Nickel!



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WRITE TO: **FRITZ** INDUSTRIAL FURNACES **HAGEN,** P. O. B. 448 (W.-GERMANY)

Improved Method of Production for Flattened Strand Ropes

(*Continued from page* 1157)

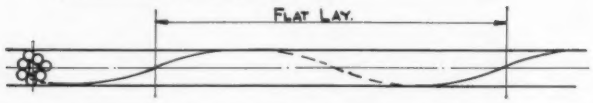

Fig. 3 — The helical twist of a flat lay strand.

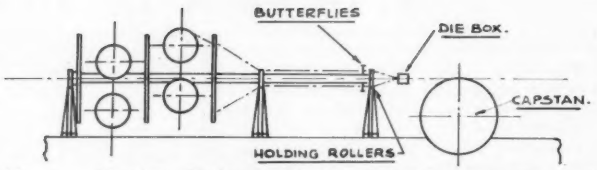

Fig. 4 — Planetary Closing Machine for flattened strand ropes.

detect any strand diversion from its correct path. The extra long front section is necessary to absorb correction without damage to the strands, and when this correction tends to become excessive the machine must be stopped, and each bobbin separately rotated. This operation is a lengthy process, and inflicts a change of construction on a strand already carefully produced. (Fig. 4).

* * *

While it must be accepted that there are difficulties in producing flattened strand which has a "flat lay" exactly suited to the final closed rope lay, it can be assumed that, with attention, strands of this type can be produced reasonably near to the closing requirements. This fact was recognized, and the closing problem approached on the basis that adjustment during production of the finished closing lay would accommodate slight errors, rather than tending to alter the "flat lay" of the strand. In other words, the machine has been designed to close the rope at a lay exactly suited to the strand produced.

New Machine Design

This high speed tubular flattened strand closing machine is designed so that all strand lead angles are reduced to a minimum; this greatly reduces the possibility of a strand being scored or distorted during the closing operation. The machine is fitted with a single drum haul-off capstan, having a positive drive from the tubular section, the speed of which is made **infinitely** variable by the introduction of specially designed hydraulic equipment. For the convenience of the operator, the hand-wheel controlling alteration of capstan speed is located close to the die box, so that by observation of any misalignment of a strand, the rope lay can be very slightly increased or decreased while the machine is running. This method eliminates the time-wasting and laborious back-

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turning of bobbins, required by the Planetary method, and ensures that strands are laid in the rope as designed and as produced on the strander, without alteration, thereby producing a better quality product. (Fig. 5).

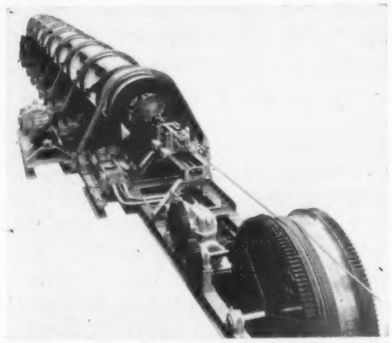

Fig. 5 — The first Larmuth & Bulmer high speed closing machine in which was incorporated a new method for closing flattened strand ropes.

The first high speed tubular closing machine of this design shown was suitable for bobbins 34" in diameter, and it has now been in successful operation for nearly two years. The machine operates at speeds up to 360 r.p.m., closing a wide range of flattened strand ropes. Since the first machine of this type was produced, many improvements over the original design have been incorporated. The makers have developed sizes suitable for 24 and 36 inch diameter bobbins. (Fig. 6). The tubular sections of the later machines are of articulated design so that each bobbin cradle is incorporated in its own independent tube length, with each tube length coupled and supported by flexible, or articulated bearings. This method of tube construction has the effect of reducing weight so that the speed can be increased up to 400 r.p.m. The conventional single roller supports have been replaced by double pairs of under rollers to obtain greater stability at high speed. It is possible to run the machine at six independent tube speeds. The controls for the machine are desk mounted so that the closing machine and the take-up can be controlled from one central point. Other improvements have been developed that relate to wire guides, cradles, brakes and die box.

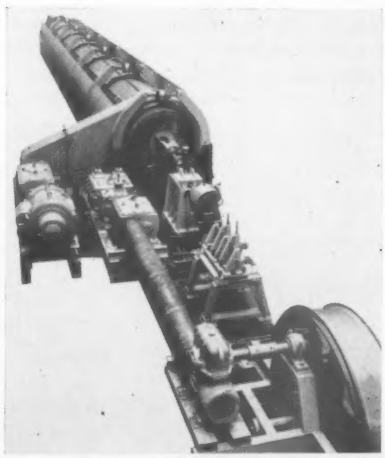

Fig. 6 — The improved Larmuth & Bulmer closing machine for flattened strand rope production.

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U.S. PATENT #2823180 AND FOREIGN PATENTS PENDING

Method for Tripping Power Circuit Breakers

(*Continued from page* 1150)

reliable. However, unless the battery is already installed and available for tripping additional breakers it will have the highest overall cost.

* * *

Number two can also be used with any type of relaying and is most versatile of the methods of tripping from an ac source of energy. It has no limitation as far as automatic reclosing is concerned since the device is designed to charge the capacitor sufficiently to trip in the interval between clearing the fault and reclosing the breaker contacts. Its principal limitation is that it will not trip immediately after the line has been deenergized for longer than a minute or two. About 12 cycles at normal voltage is required to recharge the capacitor sufficiently to trip after an outage of longer than that duration. Often this fact is not important but should be considered in the application of capacitor trip.

* * *

Although capacitor trip can be used with any type of relaying in place of a battery, it is not usual practice to do so where complex and expensive relaying is installed. Where this type of relaying scheme is considered economically justified, the additional cost of a battery is usually also considered justified. This trip has a lower first cost than number one because the battery is not required.

* * *

Number three is the most economical method since neither relays nor battery are required but it is also the most limited. It is quite dependable since the energy to trip comes from the fault current itself and is useful where the only requirement is that the breaker shall trip an overcurrent after some time delay. The principal limitation is lack of accuracy in time settings because the dash pots used to provide time delay are much less accurate than overload relays and selectivity is consequently poor. It is not recommended for those applications where it is necessary to coordinate the tripping of the breaker with other devices. Nevertheless number three is useful where its characteristics are adequate and more refinement is not economically justified. Principally it is used with small isolated manually operated breakers.

* * *

Number four is similar to number three in that it derives energy to trip from the fault current but avoids some of the limitations of number three since overcurrent relays are used to obtain accurate current and time settings. Selectivity is thus relatively good. The usual limitation of all current transformer trip schemes which should be used only where it is adequate to determine selectivity by time and magnitude of current is true here, too. Its other limitation is the high burden imposed on the current transformer (approximately

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6 ohms) by the reactors.

* * *

Number four should be used only where current transformer capacity is ample and fault currents are expected to be high. Cost is, of course, higher than number three since relays must be purchased and installed.

* * *

Number five is very similar to number four except that burden in current transformers is relatively low and it is therefore, satisfactory for use with bushing type current transformers. The secondary current, which the circuit opening contacts of the relays transfer, should be less than about 100 amperes. Roughly, number five should be used where the secondary currents, due to faults, are expected to be low, and number four where they will be high. The circuit opening relays for number five are usually a little more expensive than the circuit closing relays of number four.

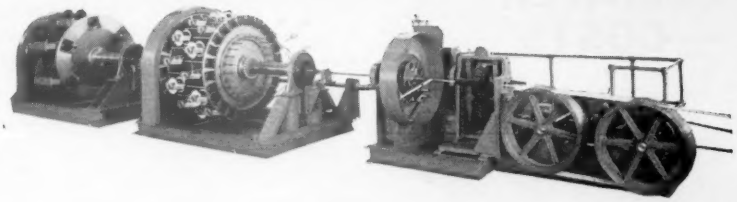
* * *

Number six is generally used only for switching and is never recommended for automatic tripping on faults because of the possible low voltage during a fault. It is sometimes used in combination with four or five for tripping from ground relays on the assumption that any ground fault which is high enough to seriously reduce the voltage of the breaker will operate one of the phase relays. Ground relays can be and often are used with schemes shown in figures one, two, four and five but were omitted from these figures for simplicity.

Battery Installations Vary With Application

Batteries customarily installed with switchgear for dc trip and other control functions are storage batteries of the lead-acid type which have time-proved reliability and long life. Standard voltages are 48, 125 and 250 with 24 being used occasionally. This type of battery is quite large and heavy and requires some sort of housing which means relative-

30 CRADLE PLANETARY CABLING MACHINE



A very efficient machine built for producing cables where a small number of large conductors and a larger number of smaller conductors and fillers are used in the construction.

6-Cradle Section fitted with side opening cradles and accommodating reels 16 inches diameter and 9⅛ inches overall width.

24-Cradle Section fitted with fast loading and shaftless cradles having means for locking reels in place and eliminating side slap and accommodating reels 8 inches diameter and 5 inches overall width.

Filling Spindles for 24 yarn packages 3 inches in diameter and 6 inches long.

The concentric taping head accommodates pads 18 inches in diameter and 3 inches wide and is our constant tension type. It is driven through a clutch, counter shaft and variable speed device.

Capstans are dual 4 groove 30 inches diameter and are driven through a variable speed device.

This Planetary Cabling Machine is one of a number which we have built handling reels 8, 10, 12, 16, 19, 24, or 30 inches in diameter. We can supply Standard Units to meet practically all requirements.

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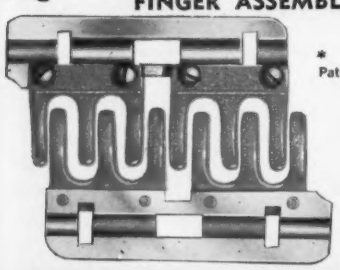

* Patented

[illegible] INDUSTRIAL CERAMIC CO.

ly high installation cost. Where economy is necessary and the only function of the battery is to supply energy for dc trip, it is possible to retain many of the advantages of dc trip at somewhat less cost by using another type of battery.

* * *

For very small isolated breakers, one or more dry cell 45-volt "B" batteries of good quality may do. A disadvantage is that they must be replaced every 6 to 8 months. This is far from common practice but has been done in a few cases. As a better solution, which can be used with a larger isolated breaker, the relatively new nickel-alkali battery with sintered plates can be considered. Where they supply only energy for tripping, this type of battery can be very small and light, compared to the lead-acid type. Sometimes they may be installed complete with charger in the same housing with the relays or in the operator cabinet of an outdoor breaker with considerable reduction in installation cost. This type of battery is not low in price but requires little maintenance and is expected to have long life.

* * *

Dc trip from a battery (No. 1) is regarded as the one thoroughly reliable method which is universally preferred except where economy is an important consideration. Capacitor trip (No. 2) probably rates second as it can retain all the accuracy and selectivity of dc trip by utilizing the same relays. Where simple overcurrent protection with accurate time delay provides adequate selectivity, either number four or number five may be the best choice. Number three rates last so far as performance is concerned but is dependable and economical where accuracy is not essential.

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Polymer Requirements and Insulating Techniques for Obtaining the Maximum Benefits of High Density Polythylene

(*Continued from page* 1144)

degree included angle taper. It will be noted that die C has an orifice diameter of 0.064 inches, and under the conditions outlined above, the critical extrusion rate of the polymer employed was 1200 fpm. By increasing the orifice diameter to 0.084 inches, the critical extrusion rate was increased to 1850 fpm, or an increase of 54 per cent.

* * *

The necessary adjustments were made to the wire speed to compensate for the larger orifice opening and still produce the desired wall thickness of the coating. The improvement in extrusion rate may be attributed to the fact that the larger die opening permits greater head pressures before melt fracture occurs. Although there may be some variations in opinion as to the advisability of drawing down wire insulation in this manner, we could notice no detrimental effects on the properties of the end product; and after 2,000 hours of testing, no thermal shock or stress cracking failures have occurred.

* * *

Preheating the wire to 300°F. is required to help eliminate the effect of strains. These insulations have normal tensile values of 5000 psi ultimate tensile and better than 500 per cent elongation.

* * *

Dies A[1], D, and E all have the same dimensions except that their final tapers are 8, 16, and 24 degrees respectively. Extrusions were made at a constant rate of 1000 fpm, and the developed head pressures were noted. Figure 5 presents this data, showing that an increase in the exit taper results in an increase in the head pressure. This effect, of course, is directly opposite to that desired. If melt fracture and roughness of the wire insulation are to be prevented, a means of reducing the head pressure must be found. Obviously, additional studies are needed on tapers of even smaller angles.

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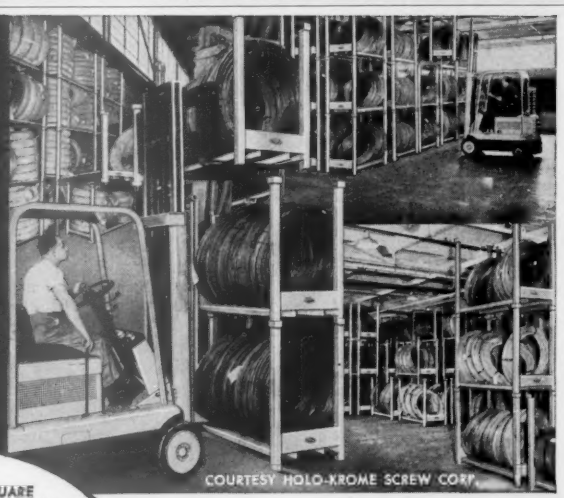

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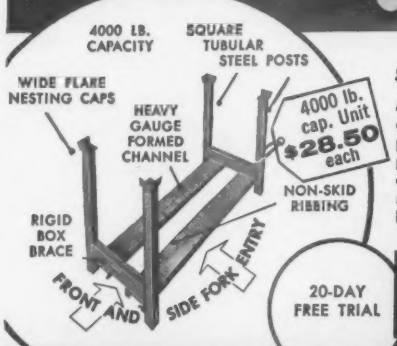

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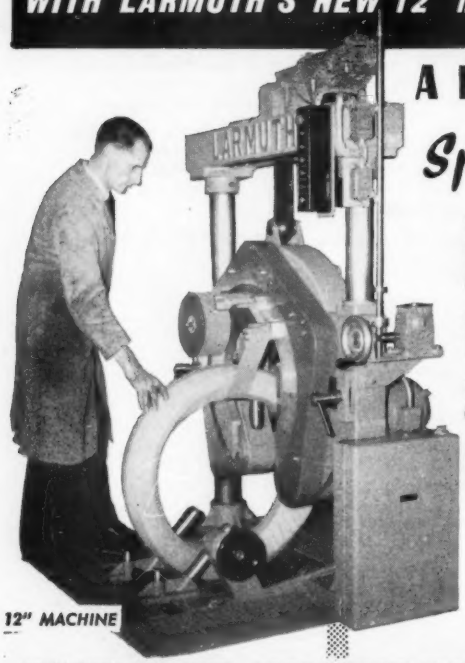

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Studies were also made of the effect of adding a 1/4-inch straight land to the 16 and 24-degree taper length of dies F and G. The data shows that the additional length of land further increases the head pressure. This work suggests that shorter tapered land lengths might bring about additional improvements in the extrusion rates.

* * *

The type of steel used and the method of making dies and tips also play a fundamental part in the extrusion process. Experimentally, the best wear and dimensional stability were obtained using steels with the following typical analysis:

DIE		TIP	
Carbon	0.72%	Carbon	0.70%
Manganese	0.25%	Manganese	2.00%
Silicon	0.20%	Silicon	0.30%
Tungsten	18.25%	Chromium	1.00%
Chromium	4.00%	Molyb-	
Vanadium	1.15%	denum	1.35%

* * *

Oxidation and surface flaking occur when steel is hardened. Use of a nitrogen atmosphere when hardening steel will help prevent these conditions. The final tip and die dimensions are usually obtained by lapping or honing the hardened article. A liquid honing process is now available which provides very accurate die tolerances.

* * *

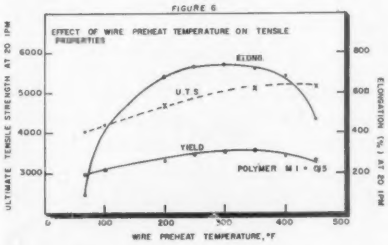
Development engineers in the Goodrich-Gulf laboratories have found that dies plated by the Electrolizing Process work very well in wire covering operations. Metal plated by this process has a surface which is nonporous, has a very low coefficient of friction, is very hard (Rockwell C-70), corrosion resistant, and easy to clean.

Wire Preheater

The physical properties of polyethylene insulations can be significantly improved by preheating the wire conductor. This phase of the extrusion process has been previously discussed by Lowe & Joyce.[3] In our work we studied the effect of wire preheat temperatures on the ultimate tensile

yield and elongation characteristics of the insulation as follows: The insulation is removed from a finished wire by stretching only the copper until the reduction in its diameter is sufficient to permit the metal to be withdrawn without disturbing the dimensions of the polyethylene covering. The polyethylene tube thus obtained and which had previously been carefully calipered for proper dimension is tested in an Instron tester at 20 inches per minute. The results of these tests are shown in Figure 6, and it is apparent that the maximum benefit in the ultimate tensile yield and elongation characteristics of the high density polyethylene is obtained when the insulation is applied to a wire which has been preheated to a temperature of about 300°F.

FIGURE 6



Although it has in the past been claimed that wire preheating is of little value, this statement cannot be made for high density polyethylene. The data presented herein indicates that when the preheater is omitted from the extrusion operation, high density polyethylene may have an elongation lower than 100 per cent; and such a low initial elongation value has a marked effect in reducing the life characteristics of the insulation. Experience has shown that polymers with poor elongation are subject to stress cracking and rapidly shorting in insulation resistance tests in a high-temperature water bath. To make successful high density polyethylene insulations, it is imperative that a preheater be a part of the wire extrusion operation.

Water Bath Temperature

The specific water bath temperature used to cool the polyethylene extrudate for obtaining

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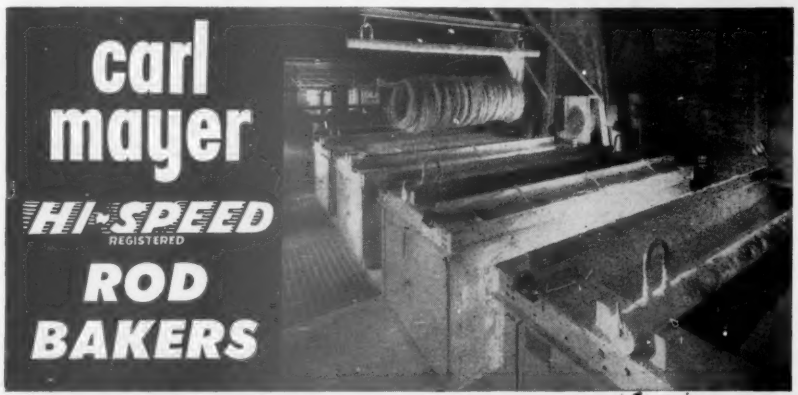

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optimum properties has been a controversial subject. Most processors use a sectioned water bath starting with hot water and gradually stepping down to cold water. In this manner, excessive shrinkage and perhaps voids in the insulation itself can be eliminated.

* * *

This procedure, however, has its drawbacks. A step-down water bath makes an extremely long cooling trough necessary to avoid deformation of the insulation as the wire winds on the take-up reel. The length of the trough will vary between 150 and 250 feet, depending upon the extrusion rate and the extrudate temperature. For extrusion at 2,000 feet a minute, a 200-foot water bath provides only six seconds cooling time. This short time does not cool high density polyethylene sufficiently to prevent deformation of the insulation.

* * *

What happens to the physical properties as the water bath temperature is changed? Generally, the tensile properties are only marginally affected by varying the water bath temperature. The thermal shock behavior of one high density polyethylene was studied over a temperature range from 15° to 140°F. Figure 7

FIGURE 7

THE EFFECT OF WATER BATH TEMPERATURE ON THERMAL SHOCK AT 100°C *

COOLING TEMPERATURE °F.	DENSITY	FAILURE (HRS)
15	0.9447	201
40	0.9465	187
60	0.9482	159
75	0.9499	152
100	0.9511	136
140	0.9520	129

* A 0.44 melt index polymer was coated on No. 20 wire with a 0.016 inch wall which was wrapped, on itself and tested in an air oven at 212°F.

shows the effect of 30-second quench temperatures on the thermal shock resistance of a 0.44 melt index high density polyethylene. The insulations were further cooled for 15 seconds in room temperature water. It has been established by Birks and Rudin[4] that rapid cooling of the polymer melt reduces its density, which ultimately increases stress cracking life. The insulations used in these tests were wrapped on themselves and aged in an air oven at 212°F. until failure occurred. It is obvious from the results that high water bath temperatures did not help the thermal shock characteristics of this particular polyethylene. More polymers will have to be studied to establish optimum bath conditions. However, this initial work does suggest that, when everything else is equal, high water bath temperatures should be avoided.

Processing

It is fairly well known that long life, high density polyethylenes are difficult to process. To speed up the rate of extrusion, we have shown that it is desirable to increase the orifice diameter of the die, particularly for these wire coatings, and draw the insulation down to size.

* * *

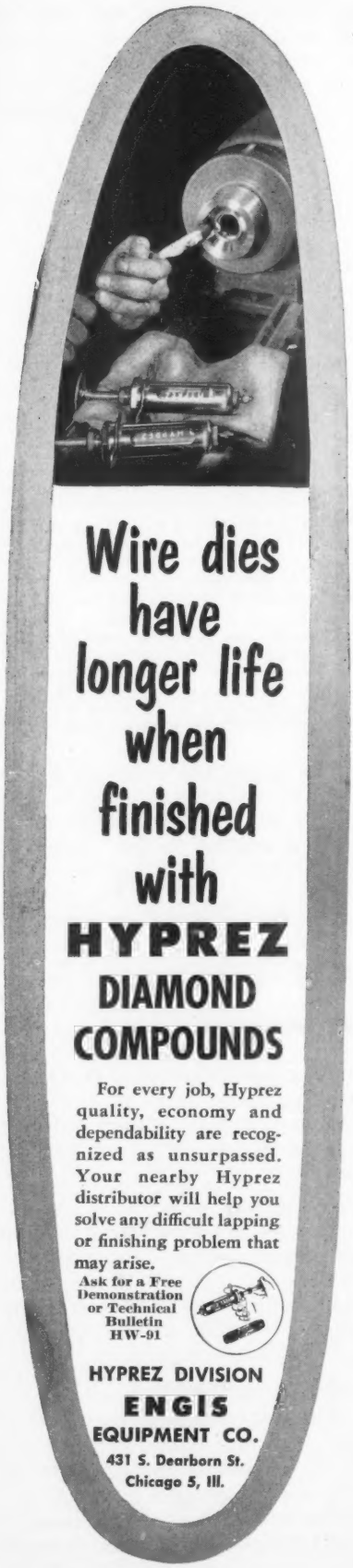
Further, it is necessary to examine the shear rate of the polyethylene used. It cannot be assumed that polyethylenes from several manufacturers will flow in the same manner merely because they have similar melt index values. Similar polymers with melt indexes of 0.2 usually do not have the same critical extrusion rates when examined at much higher shear rates. The melt fracture behavior of all of these high molecular weight, high density polyethylenes is different, and some of these differences are large.

* * *

The taper of the die exit is certainly a factor in reducing melt fracture, and it is important to keep the angle small to obtain the maximum extrusion rate. Early work indicates that electrolized dies offer a better lubricating surface for the polyethylene to work against than does a plated chrome finish.

Summary

Quality wire extrusions can now be made from high density polyethylene. Only the very high molecular weight polymers should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be used for this purpose. If these data are compared with published data on other electrical grade plastics, it appears that high density polyethylene insulations have stress cracking and thermal lives which are much superior to other electrical grade plastics. These life properties, while outstanding in themselves, can be further improved by the use of a suitable antioxidant and/or channel black. By following the techniques outlined in this paper, it is possible to reduce the processing problems often encountered with these polymers.

Acknowledgment

The author greatly appreciates the assistance of J. C. Gipson in preparing the data for this paper.

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New Developments in Wetting Agents

(*Continued from page* 1148)

result is that these separated particles are no longer able to combine with the sulphuric acid to form iron sulphates. Instead a sticky, tarry substance tends to form, which attaches itself to the wire surface immediately after the wire is removed from the pickling bath, unless the necessary precautionary measures are taken in good time. Under certain circumstances this brown-black carbonaceous substance can cause serious staining of the metal, but disappears entirely if the rolled wire is given at least two

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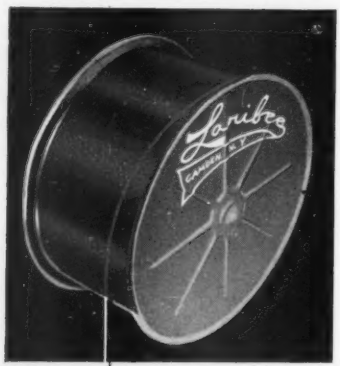

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or three passes. In the case of bar material, however, which normally receives only a single pass after pickling, much more attention must be paid to this point.

* * *

Experience shows that this phenomenon is much more pronounced with HW 592 than with Marlophene 89 and 810. The latter produce a much stronger foam, which only allows these particles to decompose to a restricted degree. This disadvantage of the foam blanket can, however, be largely overcome by taking the following precautions:

a. Push the foam aside with a piece of wood immediately before the metal is removed from the acid bath.

b. Skim off the old foam from time to time, before the entrapped scale particles have decomposed to form the tarry substance.

c. At regular intervals add small quantities of wetting agent or foaming agent. The resulting increased consumption of wetting agent will be compensated in the long run, since most of the wetting agent will be retained in the H_2SO_4 when it is crystallised out and pumped back.

* * *

The longer the foam blanket is kept in use, the greater is the the danger that this brown-black coating will be formed, which at first sight might be mistaken for decomposition of the wetting agent. It is therefore most important to carry out precaution c).

* * *

Apart from the absorption of the acid vapours mentioned earlier, the fresh foam blanket has the further advantage of maintaining the temperature of the pickling bath, resulting in practice in a considerable saving in heating power.

* * *

This principle is also used in electroplating. In a number of works "Dunstex" plastic floats, manufactured by Messrs. Langbein & Pfannhauser, are added.

Summary

The experiments described in this article relate to trials of newly developed wetting agents.

* * *

The primary object was to study the influence of these on the pick-

ling rate and on H_2SO_4 consumption per ton. Special attention was also paid to the metal surface finish when wetting agent was added.

* * *

Apart from a few teething troubles still to be overcome, such as may be experienced with all innovations, the three synthetic wetting agents used achieved a remarkable increase in efficiency compared with the old HW 54 described in the July 1959 issue of "Wire Industry".

* * *

Acid consumption as well as pickling times were reduced to a gratifying extent. The surface of the pickled coils of wire and strip came up to expectations, provided that the old foam was skimmed off the pickling bath before the metal was taken out. Certain difficulties experienced in the copper-plating of rolled wire pickled in an acid bath containing wetting agent can be overcome by using acid of greater purity. This trouble is only rarely encountered, however, as bright-drawn wire is generally used for copper-plating.

* * *

The wetting agents used were partly of the combined type and partly "pure" wetting agents, to which pickle econimiser was added in order to keep their activity in the acid bath within reasonable bounds. It is interesting that Marlophene displays to some extent the properties of a combined wetting agent. They have so far proved excellent, so that they should continue in the future to give useful service as wetting agents with H_2SO_4 pickles.

Plastic Ventilating System on Wire Coating Line Replaces Wood to Advantage

(*Continued from page* 1151)

above the three connected muriatic acid tanks. These tanks are made of rubber covered steel in which a temperature of 120°F. is maintained by means of a heat exchanger installed in the line. By aid of a pump the acid is constantly recirculated to assure effective cleaning of the wire. Frequent check of content assures the maintenance of uniformity of acid strength. A novelty in the tanks' design is the fact that no sinker rolls are required, the wire travelling in a straight line through them.

* * *

The hood over the muriatic acid line is vented by a 42 inch plastic fan powered by a 25 horsepower motor and fumes are drawn off by its tower at the rate of 30,000 cubic feet per minute. A hot rinse at the end of the muriatic acid line completes this section.

* * *

Wire now enters the zinc plating line. This line is 90-feet long and contains an acid zinc sulphate solution. Temperature of the plating tank is maintained at 110°F. to 120°F. automatically by means of temperature controller actuating a pyrex glass heat exchanger. Six pumps constantly pump solution from the bottom of the tank through insoluble anodes up to the wire line, thereby pro-

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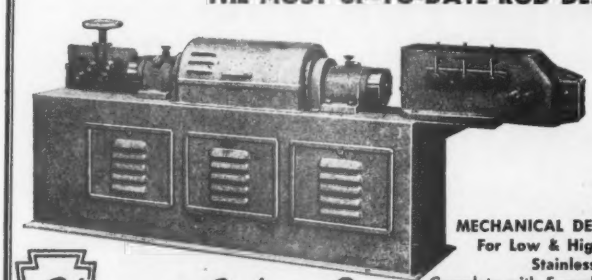

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Wire comes out of the coating line into a hot water rinse at the end of the ventilating system. Beyond this rinse are auxiliary tanks used for post-treatment of various kinds.

* * *

This section of the line is vented by two 36 inch plastic fans each powered by a 20-horsepower motor into separate towers at the rate of 20,000 cubic feet per minute.

The coating line proper begins, of course, at the payoff reels. Wire from .065 to .300 gauge butt welded end to end is paid off to a heat treating furnace 53 feet long where temperatures are automatically maintained. Three conditions of treating are embodied in this one line. Wires to be patented or fully annealed enter a neutral atmosphere in inconel tubes running the length of the furnace. Wire to be slack annealed bypasses this heat treatment by being conducted over the furnace to the lead kettle. In both processes, wires leaving the furnace pass through the pickling, wash, coating and final rinse treatments described and then on to the take-up and coiling equipment.

* * *

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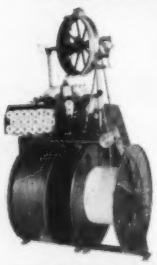

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Sidney R. Dresser, Alderkill, Rhinebeck, N. Y., passed away in June, 1961. He retired as Manager of the Robinson Division of the Mercer-Robinson Engineering Corporation two years ago, and had devoted himself to his personal interests since then.

* * *

Mr. Dresser, a well and widely-known engineer in the field of copper wire processing and electric cable manufacture, had had a long and distinguished career in the wire industry, serving the Armed Forces in procurement work during World War II, where his wide experience and knowledge of the field enabled him to render services of immeasurable value.

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A monthly magazine for men engaged in the production of wire and wire products.

The Importance of Wire in Spring Design

(*Continued from page* 1141)

Torsional Stress Information Needed

Helical springs are of three primary types: 1 — Compression, 2 — Extension, and 3 — Torsion. When load is applied to a torsion spring resulting stress of wire is that of bending or comparable to tensional stress. However, since less than 25% of coil springs produced are of the torsion type we are not as often concerned with tensional stresses as we are with those that occur in compression and extension springs.

* * *

Load application in compression and extension springs induces **torsional** stresses in wire. Herein lies a particularly important difference between information required by spring designers and actual design information available. Extensive data has been amassed over the years that gives tensional stress information in great detail for all types and diameters of wire. This data includes upper and lower tensile limits, stress-strain diagrams, influence of temperature on wire in tension; in fact, rather detailed information to determine what is likely to happen to wire in tension under various sets of conditions. This is valuable design data, however, more than 75% of our design is on compression and extension springs and therefore dependent upon torsional stress. We are much more concerned in our day to day design with what happens to wire when twisted and when we seek detailed information of this type we find it almost nonexistent. For the most part, we must interpolate torsional information from that available on tensional stress. This is usually adequate but trends in spring design seem to dictate that we acquire more precise and detailed information on torsional stress in various wire types. We can assure you that any strides that can be made in this direction by wire mills will endear you to the hearts of the spring engineer.

Technological Trends in Spring Design

Today the demand for greater precision and quality is intense in the spring manufacturing industry. Technological breakthroughs in modern day industries such as missiles and rockets, electronics and myriad other fields have forced vendors to keep pace with their exacting designs. This focuses attention on such items as the extreme importance of wire in mechanical coil springs. The fact that such fine quality wire is now available for a diversity of applications means that tremendous strides have been made to keep pace with this trend. It is indicative of the progressive nature of the wire milling industry that you have invited a representative of the spring trade to discuss some of our mutual areas of concern and we wish to

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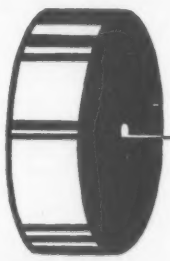

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Wire Kinks

(*Continued from page* 1155)

left in the wire from drawing. Some bare wire also is given a dip in a rust-preventing oil for added protection. Often paper is laid on the floor of the car and another layer on top of the coils to protect against dust, dirt and condensation.

* * *

More positive protection is widely supplied by wrapping the coils spirally in a paper, which is usually an asphalt laminated product about 5 inches wide and heavily creped to make possible a snug, light wrapping. Heavy coils can be protected in this manner.

* * *

Still more effective protection is possible when the coils are wrapped in chemically treated papers that emit a vapor that inhibits rusting. Such papers, usually called VPI papers, are used for wire to be trucked long distances or where rail-water shipments are employed.

* * *

For many types of coils, especially smaller ones, it is common practice to put them into sealed cartons for shipment. Some of these boxes, where corrosive atmospheric conditions are anticipated, are lined with VPI papers. Wire for baling machines is an example.

* * *

Where wire is packaged in fiber containers, the containers themselves, being sealed, afford a considerable degree of protection.

* * *

Both the Department of Commerce and the Department of Defense have packaging manuals covering the preparation of wire and wire products for shipment that embody experience gained from shipping wire all over the world.

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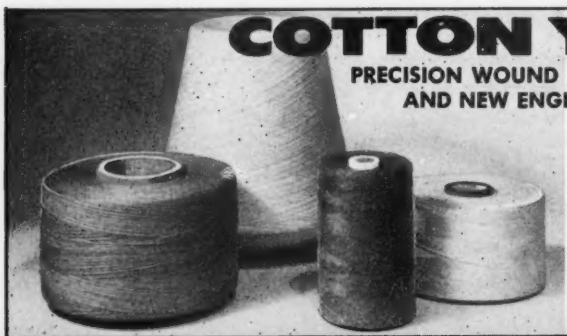

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A Review of Recent Wire Patents

(*Continued from page* 1177)

FOR USE WITH COIL-WINDING MACHINES, patented July 18, 1961 by Willem van de Hoek, Eindhoven, Netherlands, assignor to North American Philips Company, Inc., New York, N. Y., a corporation of Delaware.

A wire-unwinding device adapted for use in coil-winding machine is disclosed and comprises a base member supporting a wire-guide, an arm pivotally secured at one end to this wire-guide and carrying at least one wire unwinding wheel, and a resilient member, subject only to bending stress, fixedly positioned at both ends, and a device slidable along the arm and the resilient member for varying the effective length of the latter to thereby vary the tension of the resilient member acting on the arm. There are eight claims.

The Logarithmic Function of Equi-Reductions in Multiple Drawing Operations

(*Continued from page* 1136)

The wire is to be annealed at: .143, .109, .0838, .0641, .0490, and .0375 in. dia.

Summary

Process economy of modern high speed wire drawing requires the understanding of the physical phenomena for the accurate evaluation of the variables involved. By using the proportion principle for Log Log scales, seemingly tedious and difficult problems can be easily and rapidly solved.

References

1. **Annealing and Dies in Process Drawing of Wire. A. Mohrnheim. *Wire and Wire Products*, v. 33, Dec. 1958, p. 1465-1468B, 1507-1508. *University of Rhode Island Engineering Reprint*, No. 12, Feb. 1959.**
2. **Force and Power Requirements for Multiple Wire Drawing. A. Mohrnheim. *Wire*, Coburg, Germany; English Edition No. 47, June 1960, p. 161-165. *University of Rhode Island Engineering* Reprint, No. 24, Sept. 1960.**
3. **Elongation vs. Reduction, A New Precept. A. Mohrnheim. *Wire*, Coburg, Germany; English Edition No. 51, Feb. 1961, p. 21-24. *University of Rhode Island Engineering Reprint*, No. 30, July 1961.**

Note. Reprints are available from the Division of Engineering Research and Development, University of Rhode Island, Kingston, Rhode Island.

Acknowledgment

The writer is indebted to **Dean T. Stephen Crawford,** University of Rhode Island for encouragement in writing. Thanks are due to **Mr. J. Reiff K. Stauffer,** Professor of Mathematics, for reviewing the paper.

Disc Brakes for Forklift Trucks

The world's largest manufacturer of forklift trucks has equipped a new industrial model with a specialized brake manufactured here that provides more "hold" and less "grab."

* * *

Clark Equipment of Battle Creek, Mich., is pioneering the use of hydraulically-applied disc type brakes for forklift trucks to minimize the load-dumping danger of "grabbing" stops.

* * *

The new brakes do not grab because they are not self-energizing as conventional hydraulic drum brakes are, according to their manufacturer, **The Goodyear Tire & Rubber Company.** The truck's operator can regulate accurately the intensity of braking, controlling the disc type brakes with either foot from a wide centrally-located pedal. Enclosed within the drive axle housing instead of the drive wheels, the new brake is said to operate for the life of the lining without adjustment.

* * *

Along with improved braking, Clark says its new truck offers higher lifts at faster lifting speeds, easy steering, exceptional weight distribution and traction, and one control lever for lift and tilt.

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The Man Who Led Three Lives

For the Annual Convention of **The Wire Association** the featured speaker of the Annual Dinner is **Herbert Philbrick,** American Citizen, "Communist" and Counterspy, whose dramatic story first stirred the nation in his best-selling book, following his exposure of the infamous "Communist Eleven" as a witness for the government before Judge Medina.

* * *

He is the author of "I Led Three Lives" and "The Red Underground." His experiences are featured weekly on 150 TV stations in the program entitled "I Led Three Lives."

* * *

Everyone who knows of Herbert Philbrick's magnificent service to his country as an anti-Communist Counterspy, in which he penetrated the highest echelons of the Red Conspiracy to gain vital evidence for the FBI, will be eager to hear him in person.

* * *

By attending the Convention in French Lick, Ind., October 23-26, wire men will be able to enjoy this interesting talk, as well as the many other fine features provided in the 1961 program.

New Sub-Zero Wire Tester

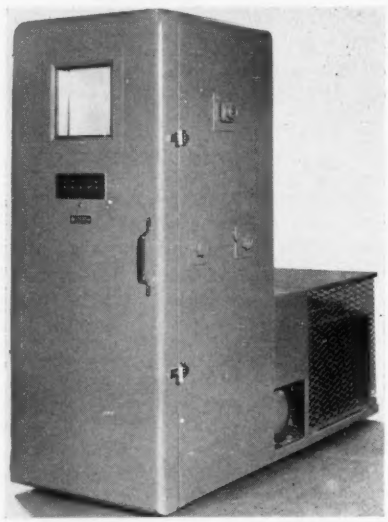
Cincinnati Sub-Zero Products, 3932 Reading Rd., Cincinnati 29, Ohio, announces WU-100-24 for testing Wire and Cable under temperature conditions from plus 80 to minus 100°F ±2°F. The pull-down is accomplished in sixty minutes.

* * *

The specially designed chamber, measuring 24" Wide, 26" Deep, and 72" High, is penetrated by a self-supporting cone-step mandrell which provides for testing on 2", 3", 4½" and 6" diameters. It may be used on the side, or the back wall of the chamber, and the rugged pillow-block construction will accommodate a test load of ½ ton.

* * *

Two 2" ports, 12" x 12", frost-free multipane window, and interior illumination, complete the



appointments. The chamber incorporates especially ducted fin coil evaporator on the rear wall which allows unencumbered use of the entire test area.

* * *

The power pack operates on current requirements of 230 volt, 60 cycle, 1 phase, and the overall dimensions are 34" Wide x 36" Deep x 86" High. Other details upon request.

New Wire and Cable Resin Coats 4,000 Feet a Minute

Development of a polyethylene resin which can be extruded to give telphone and control cables exceptionally smooth insulation coatings at speeds as high as 4,000 feet a minute has been announced by the **Polyolefins Division, Polychemicals Department,** of the duPont Company.

* * *

Known as "Alathon" 3530 polyethylene resin, it is available in commercial quantities. Ten standard Munsell colors, based on this resin and coded "Alathon" 3533, are also available, according to **Michael A. Kubico,** wire and cable industry manager.

* * *

Wire insulation produced with the new resin has excellent electrical properties. Such insulation also demonstrates fine aging properties, toughness and flex-

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ibility at low temperatures, and moisture resistance.

* * *

Thin wire insulations of "Alathon" 3530 applied at high speeds are exceedingly smooth. Laboratory measurements on 10-mil coatings over Number 22 AWG, applied at 3,800 feet per minute, deviate an average of only 13 microinches from a normal diameter. Surface measurement indicates an exceptionally smooth wire coating.

* * *

The new resin may be colored with concentrates to meet the respective color requirements of ASTM D1248-60 T, Type 1, Class A, Grade 4; L-P 590, Type II, Grade 7; and those of the Rural Electrification Administration.

* * *

Since the molecular weight of "Alathon" 3530 is higher than general purpose insulating polyethylenes, its melt index of 0.3 is lower. Stock temperatures in the range of 400 to 450 degrees Fahrenheit have provided good coatings.

Advanced Equipment for Insulating Electrical Wire Installed by Kaiser Aluminum

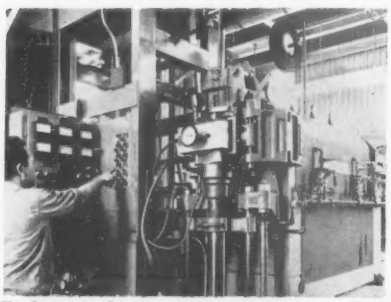
Extensive new equipment at **Kaiser Aluminum & Chemical Corporation's** plant in Bristol, R.I., provides the company with one of the world's most modern facilities for insulating copper and aluminum electrical conductors.

* * *

Known as a vertical continuous vulcanizer, the line of equipment is housed in a 126-foot aluminum-clad tower located near the center of the Bristol works. It represents the tallest and largest vertical "CV" machine in existence.

* * *

Natural and synthetic rubber insulating materials are extruded around preheated conductor at the top of the tower and cured in a 75-foot high pressure steam vulcanizing tube extending downward. The cable then continues through a water cooling tube at the same pressure level to improve density of the insulating material.



Equipment shown at the top of the 126-foot vulcanizing tower includes a conductor "splice box" and the insulation extruder. After insulating material is extruded around copper or aluminium conductors, the cable passes downward through a high pressure steam tube, then through water cooling tubes and onto a take-up reel. Kaiser Aluminum's vertical continuous vulcanizer at Bristol, R. I., can insulate cables rated up to 35,000 volts. * *

* * *

After traveling vertically, the insulated cable turns on a capstan and is cooled further in a horizontal 65-foot water tube before being hauled onto a take-up reel at ground level, completing the operation.

* * *

The equipment enables Kaiser Aluminum to insulate larger cables than before — up to 3½ inches in diameter after insula-

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tion is applied — and with superior control over surface characteristics, density, centering and roundness. In addition, the vulcanizer is capable of handling conductor lengths up to 3000 feet, sufficient for virtually any presently known requirement.

* * *

Kaiser Aluminum will use the facility for insulating and curing portable cables, building wire and power cables rated from 600 to 15,000 volts. Insulations for cables rated up to 35,000 volts can be produced should the need for such products arise.

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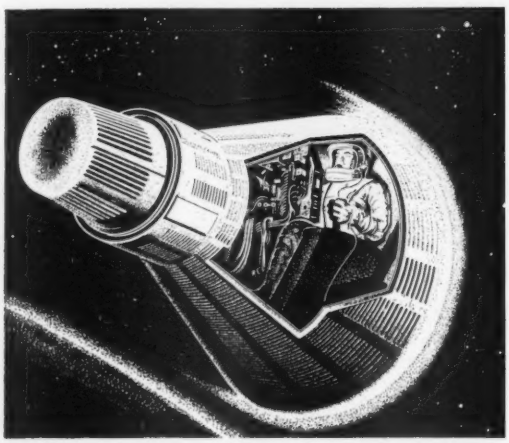

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New Monomer Casting Process Announced by Polymer Corp.

A new nylon casting process which for the first time permits low cost production of large and complex nylon shapes for tools and dies, gears, bushings, cams and other machinery components has been announced by **The Polymer Corporation,** Reading, Pa.

* * *

Louis L. Stott, Polymer president, described the process as "monomer casting", a direct conversion of nylon from basic chemical raw materials to finished parts or shapes, which he said was quite similar in techniques and costs to the conventional casting of metals.

* * *

The material, designated as MC nylon, is a Type 6 nylon formulation. However, it exhibits physical properties which span the range of properties obtainable in nearly all nylons in industrial use today.

* * *

Until now, the inherent advantages of nylon have been unavailable in large parts because of the high tooling costs and the processing limitations of conventional molding methods. In monomer casting of nylon, direct production of the finished nylon parts from monomer rather than powders of nylon polymer cuts raw material costs in half. Unlike other nylon conversion methods, monomer casting is performed at atmospheric pressure. The need for expensive molds required in conventional injection or extrusion molding of nylon polymers is eliminated. The new process will not compete with injection molding now widely used for mass production of small parts.

* * *

The basic chemistry involved in monomer casting was discovered by the **Monsanto Chemical Company.** Numerous patent applications broadly covering the process have been filed by Monsanto and a number have been issued or allowed in the United States and abroad. **The Polymer**

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EXeter 2-3700

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Stringer—for a slip cone wire drawing machine. Starting size ⅜" hot rolled aluminum wire.

Reply to—BOX 1085
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Experienced man to take complete charge of production of a diversified medium sized specialty wire mill. Products consist mainly of recoiled and respooled copper coated mild steel, low alloy steel wires, and stainless steel wires in both coarse and fine sizes.

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WIRE AND WIRE PRODUCTS
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Methods and Process knowledge of wire straightening and cutting, precision spooling and coating Aluminum, Brass and Copper. Write:

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WIRE ENGINEER

Methods and Process Knowledge of Wire Drawing, Stranding, Annealing and Plating: Salary Commensurate with Experience.

HUDSON WIRE COMPANY
62 Water Street
Ossining, New York

Index to Advertisers

A

Acrometal Products, Inc. 1172
Addison Electric Div., Muirhead Instruments 1165
Ajax Industrial Supplies, Inc. 1196
Alabama Wire Die Co. 1196
Amchem Products, Inc. 1092 and 1093
American Chain & Cable Company, Inc.
Page Steel & Wire Division 1099
American Insulating Machinery Company 1193
American Laubscher Corporation—Niehoff Machine Works 1113
American Laubscher Corporation—Braun-Angott 1173
Antrim Reel, Inc. 1192
Apco Mossberg Company 1167

B

Balloffet-Vianney Wire Die Co., Inc. 1195
Bawden, William D. 1198
Blane Corporation, The 1086
Boulin, Victor J., Inc. 1196
Brenon, Inc. 1196
Bridge Mfg. Co., The 1117
Burton Trading Company, Inc. 1190

C

Camden Wire Co., Inc. 1181
Carl Mayer Corp., The 1185
Carlton Manufacturing Co. 1197
Central Tool & Machine Co., Wire Tool Division 1191
Chadwick Yarn Company 1192
Chemical Products Corporation 1090
Circle Chemical Company 1197
Cleveland Tramrail Division
Cleveland Crane & Engineering Co. 1197
Climax Molybdenum Company, a division of
American Metal Climax, Inc. 1098
Colbourne Machine Company 1197 and 1198
Colorguard Corporation 1189
Continental Steel Corporation 1112
Cook Manufacturing Co. 1116
Coulter & McKenzie Machine Co., Inc., The Inside Front Cover

D

Danforth, C. W., Co., The 1195
Davis Electric Co. 1197
Davis Standard Division of Franklin Research
and Development Corporation 1137, 1138, 1139 and 1140
Detroit Steel Corporation 1158
Durant Manufacturing Company 1197
Durkee Manufacturing Co., Inc. 1197

E

Eastern Carbide Corp. 1106
Edmands Co., The 1181
Electro Metals Separation Co.,
Div. of M. J. Stavola Co. 1198
Elgin National Watch Company, Abrasives Division 1152
Emory, Robert J., Co. 1198
Engis Equipment Co., Hyprez Div. 1187
Entwistle Manufacturing Corporation 1164

F

Federal Manufacturing Co., The 1197
Fenn Manufacturing Company, The 1124
Fisher Associates 1198
Fort Wayne Diamond Products, Inc. 1196
Fort Wayne Wire Die, Inc. 1196

G

Gem Gravure Company, Inc. 1171
General Electric Company, Silicone Products Department 1096
General Engineering Co., (Radcliffe) Ltd. 1102
Gillies, Duncan M. Co., Inc. 1163
Glader, Wm., Machine Works 1170
Goodrich-Gulf Chemicals, Inc. 1128 and 1129

H

Haskell-Dawes Machine Co., Inc. 1184
Heany Industrial Ceramic Corp. 1182
Herborn Machinery Corp. 1107
Hoosier Wire Die, Inc. 1196
Hubbard Spool Division, Van Norman Industries, Inc. 1130

I

Indiana Wire Die Company 1196

J

Jarke Manufacturing Company 1183
Johnson Machinery Company 1198
Joliot 1169

K

Kelly Wire Die Corporation 1196
Kenner, Paul I. 1183
Keystone Steel & Wire Company 1101

L

Laribee Wire, Inc. 1188
Larmuth (1947) Ltd. 1184
Lewis Machine Company 1105
Ludlow Corporation 1188

M

Magnuson Products Corporation 1191
Malin & Company, The 1192
Maryland Fine & Specialty Wire Co., Inc. 1178
Merrimac Spool & Reel Co., Inc. 1192
Mettler Machine Tool, Inc. 1120
MH Machines, Morgardshammar Mek Verstad AB 1123
Micro Products Company 1145
Miller, R. H., Company, Inc. 1132
Monsanto Chemical Company, Plastics Division 1088
Montgomery Company, The 1193
Morgan Construction Co. 1110 and 1111
Mossberg Pressed Steel Corporation
Division of Wanskuck Co. 1176
Muirhead Instruments Inc., Addision Electric Div. 1165

N

National Machinery Co. 1087
National Machinery Exchange 1198
National Wire Die Co. 1196
Neff Laboratories, Inc., J. W. 1194
Nelson Company, The 1197
New England Butt Co.
Division of Wanskuck Company 1189
New England Wire Die Co. 1196
Niehaus, K. A. Maschinenfabrik, Paul Reicher Machinery
& Equipment, Ltd. 1126
Northwestern Steel and Wire Company 1106
Norton Company 1175

O

Ofenbau, Fritz, G.m.b.H. & Co., K.G. 1177

P

Page Steel & Wire Division
American Chain & Cable Company, Inc. 1099
Pan American Supply Company 1198
Pangborn Corporation 1094
Parkin Chemical Co., The 1197
Patterson Machine Company, The Geo C. 1168
Pittsburgh Carbide Die Co. 1196
Platt Bros. & Co., The 1197
Prutton Corporation 1166

R

Reicher, Paul, Machinery & Equipment, Ltd.
K. A. Niehaus Maschinenfabrik 1126
and H. A. Schlatter, Ltd. 1108
Robinson, M. W., Co., Inc. 1089
Roebling's, John A., Sons Division
The Colorado Fuel and Iron Corporation 1119
Roux Wire Die Works, Inc. 1182 and 1185
Royle, John & Sons 1197
Rusch Wire Die Corporation 1196

S

S.A.M.P., Emilio Wartenweiler 1121
Schlatter, H. A., Ltd.,
Paul Reicher Machinery & Equipment Ltd. 1108
Scudder, E. J. Foundry & Machine Co. 1197
Showa Machine Works Ltd. 1103
Sjogren Tool & Machine Co., Inc. 1176
Southwire Company 1115
Stamford Processing Co. 1197
Standard Industrial 1085
Standard Mill Supply Company 1193
Steel Equipment Company 1125
Straus-Artys Corp. 1189
Sumitomo Metal Industries Ltd. 1114
Superior Tool & Manufacturing Co. 1191
Swift & Company, Chemicals for Industry Department 1187
Synero Machine Company Back Cover
Synthetic Thread Co. 1190

T

Tensitron, Inc. 1197
Torrington Manufactring Company 1091
Twitchell, E. W., Inc. 1169

U

Union Carbide Plastics Company 1104
Universal Industrial Equipment Co. 1179
U.S. Borax 1186

V

Van Norman Industries, Inc.
Hubbard Spool Division 1130
Vaughn Machinery Company, The Front Cover and 1118

W

Waflos Machinery Corp. 1127
Wartenweiler, Emilio, S.A.M.P. 1121
Watson Machine Company, The Inside Back Cover
Wayne Wire Die Co. 1195
Wells, Frank L., Company 1174
Western Wire & Textile Machinery, Inc. 1183
Western Wire Corporation 1180
Whitacre Corporation 1095
Wilson, Lee, Engineering Co., Inc. 1100
Wire and Textile Machinery, Inc. 1190
Wire Machinery, Inc. 1154

Y

Yawata Iron & Steel Co., Ltd. 1122

WHERE TO BUY

For more complete information, consult the annual Wire and Wire Products Buyer's Guide. Advertisers who have contracted for 6 or more insertions are entitled to up to 8 listings in this section of Wire and Wire Products.

ABRASIVES—
Alabama Wire Die Co., Fayette, Ala.
Elgin National Watch Co., Abrasives Div., Elgin, Ill.
Hyprez Div., Engis Equipment Co., Chicago, Ill.
Indiana Wire Die Co., Ft. Wayne, Ind.
Pangborn Corporation, Hagerstown, Md.
Wheelabrator Corporation, Mishawaka, Ind.

ABRASIVES— Shot & Grit, For Cleaning
Pangborn Corporation, Hagerstown, Md.
Wheelabrator Corporation, Mishawaka, Ind.

ACID INHIBITORS—
(See Inhibitors, Pickling)

ANNEALING MACHINES — Electric Resistance
Syncro Machine Co., Perth Amboy, N. J.
Walco Electric Co., Providence, R. I.

ANNEALING POTS AND BOXES—
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.

BAKERS—
(See OVENS—Rod Bakers)

BAR—Steel
Eaton Mfg. Co., Massillon, Ohio

BOBBINS—Braider & Wire Weaving
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
Plastic Mold & Engineering Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.
Wardwell Braiding Machine Co., Central Falls, R. I.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.

BORAX—Wire Drawing
U. S. Borax, New York, N. Y.

BRAZERS—Electric for Wire
Steele Company, M. G., Rome, N. Y.

CABLE ACCESSORIES
Southwire Co., Carrollton, Ga.

CABLE—Electric
Laribee Wire Inc., Camden, N. Y.
Southwire Co., Carrollton, Ga.

CABLE FILLERS—Paper
Ludlow Corporation, Needham Heights, Mass.
Twitchell, Inc., E. W., Philadelphia, Pa.

CAPSTANS—for Wire (also Caterpiller Types)
Bartell Machine Tool Corp., Rome, N. Y.
Colbourne Machine Company, Winsted, Conn.
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Davis Electric Co., Wallingford, Conn.
Davis-Standard Div. of Franklin Research and Development Corp., Mystic, Conn.
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.
General Engineering (Radcliffe) Co., Ltd., Manchester, England

CARRIERS—Braider, High Speed
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
New England Butt Co., Division of Wanskuck Co., Providence, R. I.
Wardwell Braiding Machine Co., Central Falls, R. I.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.

CASTINGS—Wire Mill
Scudder, E. J. Fdry. & Mach. Co., Trenton, N. J.

CEMENTS—Refractory
Amchem Products, Inc., Ambler, Pa.

CLEANERS—Metal
Amchem Products, Inc., Ambler, Pa.
Apex Alkali Products Co., Phila., Pa.
Circle Chemical Co., Chicago, Ill.
Magnuson Products Corporation, Brooklyn, N. Y.
Miller, R. H., Co., Inc., Homer, N. Y.
Parkin Chemical Co., The, Pittsburgh, Pa.
Standard Industrial Compounds Co., Frankfort, Ill.

CLEANING & PICKLING EQUIP.—
Cleveland Tramrail Div., of the Cleveland Crane & Engineering Co., Wickliffe, Ohio
Morgan Construction Co., Worcester, Mass.
Wheelabrator Corporation, Mishawaka, Ind.
Wilson, Lee, Engr. Co., Cleveland, Ohio

CLOTH—Wire, All Metals—
Wickwire Bros., Cortland, N. Y.

COATING COMPOUNDS—
Amchem Products, Inc., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Chemical Products Corporation, E. Providence, R. I.
Magnuson Products Corp., Brooklyn, N. Y.
Miller, R. H., Co., Homer, N. Y.
Standard Industrial Compounds Co., Frankfort, Ill.
U. S. Borax, New York, N. Y.

COLOR CONCENTRATES—For Wire Coatings
Blane Corporation, The, Canton, Mass.

COMPOUNDS—Brazing
Steele Company, M. G., Rome, N. Y.

COMPOUNDS—Coppering
Amchem Products, Inc., Ambler, Pa.
Circle Chemical Co., Chicago, Ill.
Miller, R. H. Co., Inc., Homer, N. Y.

COMPOUNDS—Diamond (Pre-Mixed)
Alabama Wire Die Co., Fayette, Ala.
Eastern Carbide Corp., New Rochelle, N. Y.
Elgin National Watch Co., Abrasives Div., Elgin, Ill.
Hyprez Div., Engis Equipment Co., Chicago, Ill.
Indiana Wire Die Co., Ft. Wayne, Ind.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.

COMPOUNDS—Extrusion, for Wire
Amchem Products, Inc., Ambler, Pa.
Blane Corporation, The, Canton, Mass.
Circle Chemical Co., Chicago, Ill.
Monsanto Chemical Company, Plastics Division, Springfield, Mass.

COMPOUNDS—For Improving Drawing & Extrusion
Amchem Products, Inc., Ambler, Pa.
Circle Chemical Co., Chicago, Ill

COMPOUNDS—Metal Finishing
Amchem Products Inc., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Chemical Products Corporation, E. Providence, R. I.
Circle Chemical Co., Chicago, Ill.

COMPOUNDS—Phosphate Coating
Amchem Products Inc., Ambler, Pa.
Circle Chemical Co., Chicago, Ill.

COMPOUNDS—Rust Preventing
Amchem Products, Inc., Ambler, Pa.
American Lanolin Corp., Lawrence, Mass.
Apex Alkali Products Co., Philadelphia, Pa.
Chemical Products Corporation, E. Providence, R. I.
Circle Chemical Co., Chicago, Ill.

COMPOUNDS—Rust Removing
Amchem Products Inc., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Magnuson Products Corp., Brooklyn, N. Y.
Standard Industrial Compounds Co., Frankfort, Ill.

COMPOUNDS—Vinyl
Blane Corporation, The, Canton, Mass.
Chemical Products Corporation, E. Providence, R. I.
Kenrich Petrochemicals, Inc., Maspeth, N. Y.
Monsanto Chemical Company, Plastics Division, Springfield, Mass.
Union Carbide Plastics Company, Div. of Union Carbide Corporation, New York, N. Y.

COMPOUNDS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Climax Molybdenum Co., Div., American Metal Climax, Inc., New York, N. Y.
Magnuson Products Corp., Brooklyn, N. Y.
Miller, R. H. Co., Inc., Homer, N. Y.
Standard Industrial Compounds Co., Frankfort, Ill.
Swift & Company, Chicago, Ill.
U. S. Borax, New York, N. Y.

CONDUCTORS—Flexible, Electrical
Laribee Wire Inc., Camden, N. Y.
Montgomery Co., The, Windsor Locks, Conn.

CONTAINERS—Wire Packaging
(See DRUMS—Wire Packaging)

CONTROL PANELS—
Walco Electric Co., Providence, R. I.

COPHOLDERS—Steel
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
Wire & Textile Mach'y, Inc., (used), Pawtucket, R. I.

CORDS—Electrical, Tinsel Conductor
Montgomery Co., The, Windsor Locks, Conn.

COUNTERS—
(See MACHINERY—Measuring Wire and Cable)

CRANES—Wire Mill
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio
Morgan Construction Co., Worcester, Mass.

CUTTING TOOLS—Carbide
Eastern Carbide Corp., New Rochelle, N. Y.
Metallurgical Products Dept. of General Electric Co., Detroit, Mich.

CUTTING TOOLS—Wire
Manco Mfg. Co., Bradley, Ill.
Porter, H. K., Inc., Somerville, Mass.
Robinson, M. W. Co., Rockville, Conn.

DIAMONDS—Industrial
Alabama Wire Die Co., Fayette, Ala.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Indiana Wire Die Co., Ft. Wayne, Ind.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y
Wayne Wire Die Co., Linden, N. J.

DIAMOND POWDERS—
Danforth Company, C.W., Youngstown, Ohio
Elgin National Watch Co., Abrasives Div., Elgin, Ill.
Fort Wayne Diamond Products, Inc., Fort Wayne, Indiana
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Hyprez Div., Engis Equipment Co., Chicago, Ill.
Kelly Wire Die Corp., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Linden, N. J.

DIAMOND POWDER RECLAIMING—
Alabama Wire Die Co., Fayette, Ala.
Danforth Company, C.W., Youngstown, Ohio
Elgin National Watch Co., Abrasives Div., Elgin, Ill.
Fort Wayne Diamond Products, Inc., Fort Wayne, Indiana
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.

DIAMOND TOOLS—
Wayne Wire Die Co., Linden, N. J.

DIES—Carbide, Tungsten & Tantalum
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Eastern Carbide Corp., New Rochelle, N. Y.
Kelloy Corporation, New York, N. Y.
Kelly Wire Die Corp., New York, N. Y.
Metallurgical Products Dept. of General Electric Co., Detroit, Mich.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Linden, N. J.

DIES—Cold Heading
Eastern Carbide Corp., New Rochelle, N. Y.
Kelloy Corporation, New York, N. Y.
Metallurgical Products Dept. of General Electric Co., Detroit, Mich.

DIES—Diamond
Alabama Wire Die Co., Fayette, Ala.
Ajax Industrial Supplies, Inc., Ft. Wayne, Ind.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J. Inc., New York, N. Y.
Brenon, Inc., Nixon, N. J.
Ft. Wayne Wire Die Inc., Fort Wayne, Ind.
Hoosier Wire Die, Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
National Wire Die Co., Inc., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
Roux Wire Die Works, Inc., Oriskany, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Linden, N. J.

DIES DIAMOND—Controlled Drawing Angle
Hoosier Wire Die, Inc., Fort Wayne, Ind.

DIES DIAMOND—Reversible
National Wire Die Co., Inc., New York, N. Y.

DIES—Extrusion
Alabama Wire Die Co., Fayette, Ala.
Central Tool and Machine Co., Bridgeport, Conn.
Eastern Carbide Corp., New Rochelle, N. Y.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelloy Corporation, New York, N. Y.
Metallurgical Products Dept. of General Electric Co., Detroit, Mich.

Rusch Wire Die Corp., Croton-on-Hudson, N.Y.
Wayne Wire Die Co., Linden, N. J.

DIES—Eyelet
Eastern Carbide Corp., New Rochelle, N. Y.
Kelloy Corporation, New York, N. Y.

DIES—Nail, Nail Cutters, Feeder Blocks, Grippers, etc.
Pittsburgh Carbide Die Co., Monongahela, Pa.

DIES—Pointing
Fenn Manufacturing Co., Newington, Conn.
Sjogren Tool & Machine Co., Auburn, Mass.

DIES—Repairs & Re-Cutting
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Brenon, Inc., Nixon, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Ft. Wayne Wire Die, Inc., Fort Wayne, Ind.
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metallurgical Products Dept. of General Electric Co., Detroit, Mich.
National Wire Die Co., Inc., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
Roux Wire Die Works, Inc., Oriskany, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Linden, N. J.

DIES—Special Shapes, Etc.
Eastern Carbide Corp., New Rochelle, N. Y.
Kelloy Corporation, New York, N. Y.

DIES—Swaging
Fenn Manufacturing Co., Newington, Conn.
Sjogren Tool & Mach. Co., Inc., Auburn, Mass.

DIES—Tinning
Roux Wire Die Works, Inc., Oriskany, N. Y.

DIES—Tube Drawing
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Kelloy Corporation, New York, N. Y.
Kelly Wire Die Corp., New York, N. Y.
Metallurgical Products Dept. of General Electric Co., Detroit, Mich.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.

DRAW BENCHES—
(See MACHINERY—Draw Benches)

DRIVES—Variable Speed
Allis Co., Louis, Milwaukee, Wisc.
Walco Electric Co., Providence, R. I.

DRUMS—Wire Packaging
Hubbard Spool Company, Div., Van Norman Industries, Inc., Garrett, Ind.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.

DRUMS & TRAVERSES—For Cable Reels
Hubbard Spool Company, Div., Van Norman Industries, Inc., Garrett, Ind.
Republic Steel Corp., Berger Div., Canton, Ohio

DRYING EQUIPMENT—
Carl Mayer Corp., The, Cleveland, Ohio

DUST COLLECTORS—Wet or Dry
Pangborn Corporation, Hagerstown, Md.
Wheelabrator Corporation, Mishawaka, Ind.

ENGINEERS—Consulting
Bawden, William D., Wilton, Conn.

EYELETS—Brass or Zinc
Platt Bros. & Co., The, Waterbury, Conn.

FOAM PRODUCING COMPOUNDS—
Amchem Products, Inc., Ambler, Pa.
Chemical Products Corporation, E. Providence, R. I.
Parkin Chemical Co., The, Pittsburgh, Pa.

FURNACES—Annealing, Vacuum
American Laubscher Corporation, New York, N. Y.

FURNACES—Galvanizing Equipment
Ofenbau Fritz, G.m.b.H. & Co., K. G., Hagen, (W. Germany)
Wilson, Lee, Engr. Co., Cleveland, Ohio

FURNACES—Heat Treating
Carl Mayer Corp., The, Cleveland, Ohio
Ofenbau Fritz, G.m.b.H. & Co., K. G., Hagen, (W. Germany)
Wilson Lee Engr. Co., Cleveland, Ohio

FURNACES—Pot (Oil, Gas, Electric)
Ofenbau Fritz, G.m.b.H. & Co., K. G., Hagen, (W. Germany)

FURNACES—Strand Annealing
Ofenbau Fritz, G.m.b.H. & Co., K. G., Hagen, (W. Germany)

GALVANIZING EQUIPMENT—(See MACHINERY—Galvanizing Wire)

GUIDES—For Wire
Alabama Wire Die Co., Fayette, Ala.
Heany Industrial Ceramic Corp., New Haven, Conn.
Indiana Wire Die Co., Fort Wayne, Ind.

GUIDE TIPS—For Extruding Machines (See NOZZLES)

HAMMERS—Nail Heading
Pittsburgh Carbide Die Co., Monongahela, Pa.

HAMMERS—Swaging
Sjogren Tool & Machine Co., Auburn, Mass.

HOISTS—Electric
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio
Walco Electric Co., Providence, R. I.

INHIBITORS—Pickling
Amchem Products, Inc., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa
Parkin Chemical Co., The, Pittsburgh, Pa.

INKS—Printing, for Insulated Wire
Chemical Products Corporation, E. Providence, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
Gem Gravure Company, West Hanover, Mass.

INSULATING MATERIALS—
Blane Corporation, The, Canton, Mass.
Dow Corning Corporation, Midland, Mich.
General Electric Company, Insulating Materials Section, Schenectady, N. Y.
Kenrich Petrochemicals, Inc., Maspeth, N. Y.
Monsanto Chemical Company, Plastics Division, Springfield, Mass.

LACQUERNG SYSTEMS—See MACH.—Lacquering Electric Wire

LAME—LAHN—
Montgomery Co., The, Windsor Locks, Conn.

LUBRICANTS—For Metal Cutting, Stamping and Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Miller, R. H., Co., Inc., Homer, N. Y.
Standard Industrial Compounds Co., Frankfort, Ill.

LUBRICANTS—Wire Drawing
(See Compounds—Wire Drawing)

LUBRICANTS—Wire Rope
Climax Molybdenum Co., Div., American Metal Climax, Inc., New York, N. Y.
Swift & Co., Chicago, Ill.

MACHINE CONTROLS—Electronic
Allis Co., Louis, Milwaukee, Wisc.

MACHINERY—Armoring (Cable, Wire, Hose)
Watson Machine Co., Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.

MACHINERY—Assembling
Pan American Supply Co., Long Island City, N. Y.

MACHINERY—Barbed Wire
Glader Wm., Machine Works, Chicago, Ill.
Tanisaka Iron Works Ltd., Amagaski, Hyogo, Japan

MACHINERY—Blast Cleaning
Pangborn Corporation, Hagerstown, Md.
Wheelabrator Corporation, Mishawaka, Ind.

MACHINERY—Bolt, Rivet, Screw, etc.
Gavlick Machinery Corporation, Bridgeport, Conn.
National Machinery Co., Tiffin, Ohio
Prutton Corporation, Cleveland, Ohio
Straus-Artys Corp., Great Neck, N. Y.
Waterbury-Farrel Fdy. & Mach. Co., Inc., Div. of Textron, Inc., Waterbury, Conn.

MACHINERY—Braiding
New England Butt Co., Division of Wanskuck Co., Providence, R. I.
Wardwell Braiding Machine Co., Central Fall, R. I.
Wire & Textile Mach'y, Inc., (used), Pawtucket, R. I.

MACHINERY—Brazers for Wire
Steele Company, M. G., Rome, N. Y.

MACHINERY—Bunching
Cook Mfg. Co., The, Paterson, N. J.
Edmands Company, The, Cranston, R. I.
Haskell-Dawes Machine Co., Philadelphia, Pa.
Miyazaki Iron Works, Ltd., Osaka, Japan
New England Butt Co., Division of Wanskuck Co., Providence R. I.
Niehaus K. A. Maschinenfabrik, Dusseldorf-Rath, Germany
Watson Machine Co., Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y, Inc., (used), Pawtucket, R. I.

MACHINERY—Cable, Electric
Cook Mfg. Co., The, Paterson, N. J.
Haskell-Dawes Machine Co., Philadelphia, Pa.
New England Butt Co., Division of Wanskuck Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Capstans (See Capstans and Machinery—Winding Wire)

MACHINERY—Centerless Grinding & Polishing
American Laubscher Corp., New York, N. Y.

MACHINERY—Chain Link Fence
Norton & Co., Ltd., Sir James Farmer, Manchester, England
Pan American Supply Co., Long Island City, N. Y.
Wafios Machinery Corp., Hackensack, N. J.

MACHINERY—Chain Making
Pan American Supply Co., Long Island City, N. Y.
Wafios Machinery Corp., Hackensack, N. J.

MACHINERY—Closing Cable
Miyazaki Iron Works, Ltd., Osaka, Japan
Niehaus, K. A. Maschinenfabrik, Dusseldorf-Rath, Germany
Watson Machine Co., Paterson, N. J.

MACHINERY—Coiling Rod
Coulter & MacKenzie Machine Co., Bridgeport, Conn.
Vaughn Mach'y Co., Cuyahoga Falls, Ohio
Waterbury-Farrel Fdy. & Mach. Co., Inc., Div. of Textron, Inc., Waterbury, Conn.

MACHINERY—Cold Forging
National Machinery Co., Tiffin, Ohio
Unitech Products, Inc., Hartford, Conn.

MACHINERY—Cold Heading
National Machinery Co., Tiffin, Ohio
REM Sales Incorporated, Subsidiary of The Robert E. Morris Co., West Hartford, Conn.
Straus-Artys Corp., Great Neck, N. Y.
Waterbury-Farrel Fdy. & Mach. Co., Inc., Div. of Textron, Inc., Waterbury, Conn.

MACHINERY—Copper Wire Drawing
Cook Mfg. Co., The, Paterson, N. J.
Herborn Machinery Corporation, Hackensack, N. J.
Johnson Machinery Co., Elizabeth, N. J.
Loma Machine Manufacturing Co., New York, N.Y.
Morgardshammars Mek Verkstads A. B., Morgardshammar, Sweden
National Mach'y Exch., (Used), New York
Showa Machine Works, Ltd., Osaka, Japan
Straus-Artys Corp., Great Neck, N. Y.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Manufacturing Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, Ohio
Waterbury-Farrel Fdy. & Mach. Co., Inc., Div. of Textron, Inc., Waterbury, Conn.
Whitacre Corporation, Alhambra, California

MACHINERY—Covering Wire (See MACHINERY—Insulating Wire)
Eisler Engineering Company, Newark, N. J.
Lewis Machine Co., The, Cleveland, Ohio
Mettler Machine Tool, Inc., New Haven, Conn.
Wire Machinery, Inc., Chicago, Ill.

MACHINERY—Cutters, Hydraulic for Rod & Bar
Manco Mfg. Co., Bradley, Ill.
Porter, H. K., Inc., Somerville, Mass.

MACHINERY—Dead Block (Stationary Coiler)
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, Ohio
Wells Company, Frank L., Kenosha, Wisc.
Whitacre Corporation, Alhambra, California
Wire Machinery, Inc., Chicago, Ill.

MACHINERY—Descaling Rod, Dry
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Fisher Associates, New York, N. Y.
Herborn Machinery Corporation, Hackensack, N. J.
Pangborn Corporation, Hagerstown, Md.
Wheelabrator Corporation, Mishawaka, Ind.
Wire Machinery, Inc., Chicago, Ill.

MACHINERY—Die Making
Alabama Wire Die Co., Fayette, Ala.
Boulin, Victor J., Inc., New York, N. Y.
Dykrex Corp., Roos Tool & Mfg. Div., Newark, N. J.
Indiana Wire Die Co., Ft. Wayne, Ind.
Metallurgical Products Dept. of General Electric Co., Detroit, Mich.
Sjogren Tool & Machine Co., Auburn, Mass.
Wayne Wire Die Co., Linden, N. J.

MACHINERY—Draw Benches
American Laubscher Corp., New York, N. Y.

Gavlick Machinery Corporation, Bridgeport, Conn.
Loma Machine Manufacturing Co., New York, N. Y.
Morgan Construction Co., Worcester, Mass.
Torrington Manufacturing Co., Torrington, Conn.
Vaughn Mach'y Co., Cuyahoga Falls, Ohio
Wire Machinery, Inc., Chicago, Ill.

MACHINERY—Edging (See MACHINERY—Tandem Rolling and Edging Mills)

MACHINERY—Enameling
Acrometal Products, Inc., Minneapolis, Minn.
American Insulating Mach'y Co., Phila., Pa.
Cook Mfg. Co., The, Paterson, N. J.
Cold Forging Machines, Inc., Elyria, Ohio

MACHINERY—Extruding
Davis-Standard Division of Franklin Research and Development Corporation, Mystic, Conn.
General Engineering (Radcliffe) Co., Ltd., Manchester, England
Johnson Machinery Co., Elizabeth, N. J.
Royle, John, & Sons, Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.

MACHINERY—Fence
Glader, Wm., Machine Works, Chicago, Ill.
Norton & Co., Ltd., Sir James Farmer, Manchester, England
Wafios Machinery Corp., Hackensack, N. J.

MACHINERY—Flat Wire
Fenn Manufacturing Co., Newington, Conn.
Herborn Machinery Corporation, Hackensack, N. J.
Loma Machine Manufacturing Co., New York, N. Y.
Mettler Machine Tool, Inc., New Haven, Conn.
Stanat Mfg. Co., Inc., Westbury, L. I., N. Y.
Steel Equipment Company, Cleveland, Ohio
Torrington Manufacturing Co., Torrington, Conn.

MACHINERY—Forming Wire
Cold Forging Machines, Inc., Elyria, Ohio
Gavlick Machinery Corporation, Bridgeport, Conn.
National Mach'y Exch., (Used), New York, N. Y.
Pan American Supply Co., Long Island City, N. Y.
Straus-Artys Corp., Great Neck, N. Y.
Wafios Machinery Corp., Hackensack, N. J.

MACHINERY—Galvanizing Wire
Miyazaki Iron Works, Ltd., Osaka, Japan
Ofenbau Fritz G.m.b.H. & Co., K. G., Hagen, (W.-Germany)
Vaughn Mach'y Co., Cuyahoga Falls, Ohio
Whitacre Corporation, Alhambra, California
Wilson, Lee, Engr. Co., Cleveland, Ohio

MACHINERY—Gang Winders
Entwistle Manufacturing Corporation, Providence, R. I.

MACHINERY—Insulating Wire
American Insulating Mach'y. Co., Phila., Pa.
Davis Electric Co., Wallingford, Conn.
Davis-Standard Division of Franklin Research and Development Corporation, Mystic, Conn.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Pourtier Pere et Fils, Romainville (Seine), France
Royle, John & Sons, Paterson, N. J.
Wardwell Braiding Machine Co., Central Falls, R. I.

MACHINERY—Insulation Testing (See MACHINERY—Spark Testing)

MACHINERY—Lacquering Electric Wire
Cook Mfg. Co., The, Paterson, N. J.

MACHINERY—Lock Washer
Wafios Machinery Corp., Hackensack, N. J.

MACHINERY—Looms, Wire Weaving
Cold Forging Machines, Inc., Elyria, Ohio
EVG., Maschinen & Stahl, A. G., Zurich, Switzerland

MACHINERY—Material Handling
(See Material Handling Equipment)

MACHINERY—Measuring Wire & Cable
Davis Electric Co., Wallingford, Conn.
Durant Mfg. Co., Milwaukee, Wisc.
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.
General Engineering (Radcliffe) Co., Ltd., Manchester, England
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.

MACHINERY—Measuring and Control—Coating
Davis-Standard, Div. of Franklin Research and Development Corp., Mystic, Conn.

MACHINERY—Nail and Tack
Cold Forging Machines, Inc., Elyria, Ohio
Glader, Wm., Machine Works, Chicago, Ill.
National Machinery Co., Tiffin, Ohio
National Mach'y Exch. (Used), N.Y., N.Y.
Pan American Supply Co., Long Island City, N. Y.
Tanisaka Iron Works Ltd., Amagaski, Hyogo, Japan
Wafios Machinery Corp., Hackensack, N. J.

MACHINERY—Packaging Wire
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Vaughn Machinery Co., Cuyahoga Falls, Ohio
Whitacre Corporation, Alhambra, California

MACHINERY—Patenting Wire
Ofenbau Fritz G.m.b.H. & Co., K. G., Hagen, (W.-Germany)
Vaughn Machinery Co., Cuyahoga Falls, Ohio
Whitacre Corporation, Alhambra, California

MACHINERY—Pin
REM Sales Incorporated, Subsidiary of The Robert E. Morris Company, West Hartford, Conn.

MACHINERY—Plating
Bartell Machine Tool Corp., Rome, N. Y.
Cold Forging Machines, Inc., Elyria, Ohio
Universal Industrial Equipment Co., Secaucus, N. J.

MACHINERY—Pointing
Herborn Machinery Corporation, Hackensack, N. J.
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch., (Used), New York, N. Y.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Straus-Artys Corp., Great Neck, N. Y.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Mach'y Co., Cuyahoga Falls, Ohio
Waterbury-Farrel Fdy. & Mach. Co., Inc., Div. of Textron, Inc., Waterbury, Conn.

MACHINERY—Preheaters, Wire
Federal Manufacturing Company, Wallingford, Conn.
Walco Electric Co., Providence, R. I.

MACHINERY—Printing on Electric Wire
Entwistle Manufacturing Corporation, Providence, R. I.
Gem Gravure Co., West Hanover, Mass.
Gillies, Duncan M., Co., Inc., West Boylston, Mass.

MACHINERY—Re-Spooling
Acrometal Products, Inc., Minneapolis, Minn.
Bartell Machine Tool Corp., Rome, N. Y.
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Davis Electric Co., Wallingford, Conn.
Emory Company, Robert J., Newark, N. J.
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.
Herborn Machinery Corporation, Hackensack, N. J.
Miyazaki Iron Works, Ltd., Osaka, Japan
National Mach'y Exch. (Used), New York, N. Y.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y Inc., (used), Pawtucket, R. I.

MACHINERY—Rod Mill
Herborn Machinery Corporation, Hackensack, N. J.
Morgan Construction Co., Worcester, Mass.

MACHINERY—Rolling Mill
Fenn Manufacturing Co., Newington, Conn.
Loma Machine Manufacturing Co., New York, N. Y.
Morgan Construction Co., Worcester, Mass.
Stanat Mfg. Co., Inc., Westbury, L. I., N. Y.
Waterbury-Farrel Fdy. & Mach. Co., Inc., Div. of Textron, Inc., Waterbury, Conn.

MACHINERY—Rubber Insulating
Davis-Standard Division of Franklin Research and Development Corporation, Mystic, Conn.
Royle, John & Sons, Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y Inc., (used), Pawtucket, R. I.

MACHINERY—Serving
Pourtier Pere et Fils, Romainville (Seine), France
Wardwell Braiding Machine Co., Central Falls, R. I.

MACHINERY—Slitting Mills
Stanat Mfg. Co., Inc., Westbury, L. I., N. Y.
Steel Equipment Company, Cleveland, Ohio

MACHINERY—Special
Stanat Mfg. Co., Inc., Westbury, L. I., N. Y.

MACHINERY—Spring Making
Cold Forging Machines, Inc., Elyria, Ohio
Gavlick Machinery Corporation, Bridgeport, Conn.
National Mach'y Exch., (Used), New York, N. Y.
Pan American Supply Co., Long Island City, N. Y.
Torrington Manufacturing Co., Torrington, Conn.
Wafios Machinery Corp., Hackensack, N. J.
Wells Company, Frank L., Kenosha, Wisc.

MACHINERY—Straightening & Cutting
American Laubscher Corp., New York, N. Y.
Cold Forging Machines, Inc., Elyria, Ohio
Gavlick Machinery Corporation, Bridgeport, Conn.
Johnson Machinery Co., Elizabeth, N. J.
Lewis Machine Co., The, Cleveland, Ohio
Loma Machine Manufacturing Co., New York, N. Y.
Mettler Machine Tool Co., New Haven, Conn.
National Mach'y Exch. (Used), New York, N.Y.
Pan American Supply Co., Long Island City, N. Y.
Patterson Machine Co., The Geo. C., Cleveland, Ohio
Vaughn Machinery Co., Cuyahoga Falls, Ohio
Wafios Machinery Corp., Hackensack, N. J.
Wells Company, Frank L., Kenosha, Wisc.

MACHINERY—Stranding
Bartell Machine Tool Corp., Rome, N. Y.
Cold Forging Machines, Inc., Elyria, Ohio
Haskell-Dawes Machine Co., Phila., Pa.
Johnson Machinery Co., Elizabeth, N. J.
Miyazaki Iron Works, Ltd., Osaka, Japan
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Stanat Mfg. Co., Inc., Westbury, L. I., N. Y.
Superior Tool & Manufacturing Company, Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Swaging
Fenn Manufacturing Co., Newington, Conn.
Gavlick Machinery Corporation, Bridgeport, Conn.

MACHINERY—Tandem Rolling & Edging Mills
Fenn Manufacturing Co., Newington, Conn.
Loma Machine Manufacturing Co., New York, N. Y.
Stanat Mfg. Co., Inc., Westbury, L. I., N. Y.

MACHINERY—Take-Up and Pay-Out
Acrometal Products, Inc., Minneapolis, Minn.
American Insulating Mach'y Co., Phila., Pa.
Bartell Machine Tool Corp., Rome, N. Y.
Colbourne Machine Company, Winsted, Conn.
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Davis Electric Co., Wallingford, Conn.
Davis-Standard Division of Franklin Research and Development Corporation, Mystic, Conn.
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.
Fenn Manufacturing Co., Newington, Conn.
General Engineering (Radcliffe) Co., Ltd., Manchester, England
Johnson Machinery Co., Elizabeth, N. J.
Miyazaki Iron Works, Ltd., Osaka, Japan
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Pourtier Pere et Fils, Romainville (Seine) France
Stanat Mfg. Co., Inc., Westbury, L. I., N. Y.
Standard Mill Supply Co., Pawtucket, R. I.
Steel Equipment Company, Cleveland, Ohio
Tanisaka Iron Works Ltd., Amagaski, Hyogo, Japan
Vaughn Machinery Co., Cuyahoga Falls, Ohio
Wardwell Braiding Machine Co., Central Falls, R. I.
Watson Machine Co., Paterson, N. J.
Whitacre Corporation, Alhambra, California

MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Pourtier Pere et Fils, Romainville (Seine) France
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Thread Rolling
Mettler Machine Tool, Inc., New Haven, Conn.
Prutton Corporation, Cleveland, Ohio
Straus-Artys Corp., Great Neck, N. Y.
Waterbury-Farrel Fdy. & Mach. Co., Inc., Div. of Textron, Inc., Waterbury, Conn.
Wire Machinery, Inc., Chicago, Ill.

MACHINERY—Tinning Wire
American Insuating Mach'y Co., Phila., Pa.
Cook Mfg. Co., The, Paterson, N. J.

Ofenbau Fritz G.m.b.H. & Co. K. G., Hagen, (W.-Germany)
Universal Industrial Equipment Co., Secaucus, N. J.
Whitacre Corporation, Alhambra, California

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y Co., Phila., Pa.

MACHINERY—Trolley Wire
Torrington Manufacturing Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, Ohio

MACHINERY—Tube Mill, Cold Drawing
Johnson Machinery Co., Elizabeth, N. J.
Loma Machine Manufacturing Co., New York, N. Y.
Mettler Machine Tool, Inc., New Haven, Conn.

MACHINERY—Twinning
(See Mach.—Bunching)

MACHINERY—Twisters, Wire
Cook Manufacturing Co., The, Paterson, N.J.
Edmands Company, The, Cranston, R. I.
Haskell-Dawes Machine Co., Philadelphia, Pa.

MACHINERY—Used
Gavlick Machinery Corporation, Bridgeport, Conn.
Johnson Machinery Co., Elizabeth, N. J.
National Machinery Exchange, New York, N. Y.
Wire & Textile Machy., Inc., Pawtucket, R. I.
Wire Machinery, Inc., Chicago, Ill.

MACHINERY—Variable Speed Drives
Allis Co., Louis, Milwaukee, Wisc.

MACHINERY—Welded Wire Mesh
EVG, Maschinen and Stahl, A.G., Zurich, Switzerland
Schlatter, Ltd., H.A., Zollikon, Zurich

MACHINERY—for Wire Welding
(See WELDERS—Butt and Spot and Machinery—Welding Wire Fabrics)

MACHINERY—Winding Wire
Davis Electric Co., Wallingford, Conn.
Davis-Standard Div. of Franklin Research and Development Corp., Mystic, Conn.
Emory Company, Robert J., Newark, N. J.
Federal Manufacturing Company, Wallingford, Conn.
Miyazaki Iron Works, Ltd., Osaka, Japan
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Standard Mill Supply Co., Pawtucket, R. I.
Steel Equipment Company, Cleveland, Ohio
Straus-Artys Corp., Great Neck, N. Y.

MACHINERY—Wire Drawing
American Laubscher Corporation, New York, N. Y.
Cook Manufacturing Co., The, Paterson, N.J.
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Fenn Manufacturing Co., Newington, Conn.
Gavlick Machinery Corporation, Bridgeport, Conn.
Herborn Machinery Corporation, Hackensack, N. J.
Johnson Machinery Co., Elizabeth, N. J.
Loma Machine Manufacturing Co., New York, N. Y.
Miyazaki Iron Works, Ltd., Osaka, Japan
Morgan Construction Co., Worcester, Mass.
Morgardshammars Mek Verkstads AB, Morgardshammar, Sweden
National Mach'y Exch. (Used), New York, N. Y.
Norton & Co., Ltd., Sir James Farmer, Manchester, England
Pan American Supply Co., Long Island City, N. Y.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Showa Machine Works Ltd., Osaka, Japan
Societa Generale Delle Macchine Mill, Milan, Italy
Stanat Mfg. Co., Inc., Westbury, L. I., N. Y.
Straus-Artys Corp., Great Neck, N. Y.
Superior Tool & Machinery Company, Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Tanisaka Iron Works Ltd., Amagaski, Hyogo, Japan
Vaughn Mach'y Co., Cuyahoga Falls, Ohio
Wartenweiler, Emilio, Milano, Italy—SAMP
Waterbury-Farrel Fdy. & Mach. Co., Inc., Div. of Textron, Inc., Waterbury, Conn.
Whitacre Corporation, Alhambra, California
Wire Machinery Inc., Chicago, Ill.

MACHINERY—Wire Rope
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Watson Machine Co., Paterson, N. J.

MACHINERY—Wrapping with Paper
American Laubscher Corp, New York, N. Y.
Larmuth (1947) Ltd., Cheshire, England

MATERIAL HANDLING EQUIPMENT—
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, Ohio

MOLYBDENUM-DISULFIDE—Lubricants
Climax Molybdenum Company, a division of American Metal Climax, Inc., New York, N. Y.

MOTORS—Electric
Allis Co., Louis, Milwaukee, Wisc.
Walco Electric Co., Providence, R. I.

NAIL TOOLING—Tungsten Carbide
Pittsburgh Carbide Die Co., Monongahela, Pa.

NAILS—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Wickwire Brothers, Inc., Cortland, N. Y.

NIPPERS—Wire Cutting
Robinson, M. W. Co., Rockfall, Conn.

NOZZLES—For Extruding Machines
Central Tool and Mach. Co., Bridgeport, Conn.

OVENS—Cable Lacquering and Enameling
American Insulating Mach'y Co., Phila., Pa.
Carl Mayer Corp., The, Cleveland, Ohio
Colbourne Machine Co., Winsted, Conn.

OVENS—Rod Bakers
Carl Mayer Corp., The, Cleveland, Ohio

OVENS—Welding Rod Coating
Carl Mayer Corp., The, Cleveland, Ohio

PAILS—Packaging
(See Drums—Wire Packaging)

PAPER—Coil Wrapping
Ludlow Corporation, Needham Heights, Mass.

PAPER—Insulating
Ludlow Corporation, Needham Heights, Mass.
Twitchell, Inc., E. W., Philadelphia, Pa.

PAY-OUT SYSTEMS—
(See MACHINERY—Take-Up & Pay-Out)

PHOSPHATE COATING CHEMICALS
(See COMPOUNDS—Phosphate Coating)

PICKLING COMPOUNDS—
See (Inhibitors—Pickling)

PLASTICIZERS—
Kenrich Petrochemicals, Inc., Maspeth, N. Y.
Monsanto Chemical Company, Plastics Division, Springfield, Mass.

PLASTICS—for Wire Insulation
Blane Corporation, The, Canton, Mass.
Chemical Products Corporation, E. Providence, R. I.
Dow Corning Corporation, Midland, Mich.
Kenrich Petrochemicals, Inc., Maspeth, N. Y.
Monsanto Chemical Company, Plastics Division, Springfield, Mass.
Union Carbide Plastics Company, Div. of Union Carbide Corporation, New York, N. Y.

PREHEATERS—Wire
Federal Manufacturing Company, Wallingford, Conn.
Walco Electric Co., Providence, R. I.

PRINTING WHEELS—for Electric Wire
Entwistle Manufacturing Corporation, Providence, R. I.
Gem Gravure Co., Inc., West Hanover, Mass.
Gillies, Duncan M., Co., Inc., West Boylston, Mass.

PULLERS AND GRIPS—for Wire
Morgan Construction Co., Worcester, Mass.
Scudder, E. J. Fdry. & Mach. Co., Trenton, N. J.
Sjogren Tool & Mach. Co., Auburn, Mass.

RACKS—Wire Storage
Jarke Manufacturing Co., Chicago, Illinois

REEL AND TENSION STANDS—
Acrometal Products, Inc., Minneapolis, Minn.
Mettler Machine Tool, Inc., New Haven, Conn.
Standard Mill Supply Co., Pawtucket, R. I.
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS & SPOOLS—Aluminum Alloy
Acrometal Products, Inc., Minneapolis, Minn.
Hubbard Spool Company Div., Van Norman Industries, Inc., Garrett, Ind.
Merrimac Spool & Reel Co., Inc., Haverhill, Mass.
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS & SPOOLS—Annealing and Stranding
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Company Div., Van Norman Industries, Inc., Garrett, Ind.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
Republic Steel Corp., Berger Div., Canton, Ohio

REELS & SPOOLS—Custom Made
Merrimac Spool & Reel Co., Inc., Haverhill, Mass.

REELS—Metal Bound
Durkee Mfg. Co., Inc., Pine River, Minn.
Hubbard Spool Company Div., Van Norman Industries, Inc., Garrett, Ind.

REELS—Plywood
Antrim Reel, Inc., Haverhill, Mass.
Hubbard Spool Company Div., Van Norman Industries, Inc., Garrett, Ind.

REELS & SPOOLS—Steel (All Types)
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Carlton Manufacturing Co., Pawtucket, R. I.
Clark Manufacturing Co., J. L., Rockford, Illinois
Hubbard Spool Company Div., Van Norman Industries, Inc., Garrett, Ind.
Merrimac Spool & Reel Co., Inc., Haverhill, Mass.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
Republic Steel Corp., Berger Div., Canton, Ohio
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS—Wire Mill
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Bridge Mfg. Co., The, Hazardville, Conn.
Durkee Mfg. Co. Inc., Pine River, Minn.
Hubbard Spool Company Div., Van Norman Industries, Inc., Garrett, Ind.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
Nelson Co., The, Baltimore, Md.
Republic Steel Corp., Berger Div., Canton, Ohio
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS & SPOOLS—Wood
Antrim Reel, Inc., Haverhill, Mass.
Bridge Mfg. Co., The, Hazardville, Conn.
Durkee Mfg. Co., Inc., Pine River, Minn.
Hubbard Spool Company Div., Van Norman Industries, Inc., Garrett, Ind.
Nelson Co., The, Baltimore, Md.

ROD BAKERS—
(See OVENS—Rod Bakers)

RODS—Stainless Steel
American Steel & Wire Div., United States Steel Corp., Cleveland, Ohio
Western Wire Corporation, Boston, Mass.

RODS—Wire—Non-Ferrous
Platt Bros. & Co., The, Waterbury, Conn.

RODS—Steel
American Steel & Wire Div., United States Steel Corp., Cleveland, Ohio
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Denver, Oakland & New York City.
Continental Steel Corp., Kokomo, Ind.
Detroit Steel Corporation, Detroit, Mich.
Eaton Mfg. Co., Massillon, Ohio
Keystone Steel & Wire Co., Peoria, Ill.
Niederrheinische Huette, A. G., Duisburg, Germany
Northwestern Steel & Wire Co., Sterling, Illinois
Sumitomo Metal Industries, Ltd., Osaka, Japan
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.
Yawata Iron & Steel Co., Ltd., Tokyo, Japan

ROPE—Wire
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Roebling's, John A. Sons, Div., Colorado Fuel & Iron Corp., Trenton, N. J.

RUST PROOF COMPOUNDS—
(See COMPOUNDS—RUST Removing)

RUST REMOVING COMPOUNDS—
(See COMPOUNDS—RUST Preventing)

SCRAP WIRE—Bare or Insulated, Bought
Electro Metals Separation Co. Div. of M. J. Stavola & Co., Inc., Danbury, Conn.

SILICONE RUBBER—For Wire Insulation
Dow Corning Corporation, Midland, Mich.

SOAPS—Industrial and Wire Drawing
(See COMPOUNDS—Wire Drawing)

SPOOLS—For Retail Sale of Wire
Antrim Reel, Inc., Haverhill, Mass.
Carlton Manufacturing Co., Pawtucket, R. I.
Clark Manufacturing Co., J. L., Rockford, Illinois

SPOOLS—Paper
Merrimac Spool & Reel Co., Inc., Haverhill, Mass.

SPOOLS—Plastic
Hubbard Spool Company Div., Van Norman Industries, Inc., Garrett, Ind.
Merrimac Spool & Reel Co., Inc., Haverhill, Mass.
Plastic Mold & Eng. Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.

STAMPINGS—Steel
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.

STOCK STORAGE SYSTEMS—
Jarke Manufacturing Co., Chicago, Illinois

STRAND—Galvanized Steel
Southwire Co., Carrollton, Ga.

STRIP—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.

Roebling's, John A. Sons Div., Colorado Fuel & Iron Corp., Trenton, N. J.

TANKS—Ceramic, for Galvanizing
Ofenbau Fritz G.m.b.H. & Co. K. G., Hagen, (W.-Germany)

TENSION METERS—for Wire
Boulin Instrument Corp., Pelham, N. Y.
Tensitron, Inc., Harvard, Mass.

TESTERS—INSULATION
(See Testing Equipment—for Dielectric Faults)

TESTING EQUIPMENT—Dielectric Faults in Insulation
Davis Electric Co., Wallingford, Conn.
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.

TESTING EQUIPMENT—Physical
Scott Testers, Inc., Providence, R. I.
Steele Company, M. G., Rome, N. Y.

TINSEL—Electric Conductor
Montgomery Co., The, Windsor Locks, Conn.

TINSEL WIRE—Resistance, Lame, Decorative Cords Thread—Bare Copper Silver and False Gold Coated, etc.
(See TINSEL-Electric Conductor)

TOOLS—Nail Machine
Pittsburgh Carbide Die Co., Monongahela, Pa.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio

TRANSMISSIONS—Variable Speed (See Adjustable Speed Drives)

TRAVERSE & DRUMS—For Reels
(See Drums & Traverses)

TRAVERSE MECHANISMS—
Davis Electric Co., Wallingford, Conn.
Emory Company, Robert J., Newark, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.

VARNISHES & LACQUERS—for Electric Wire
Chemical Products Corporation, E. Providence, R. I.
General Electric Company, Insulating Materials Section, Schenectady, N. Y.

VULCANIZING PANS AND EQUIPMENT—
American Insulating Mach'y Co., Phila., Pa.
Mossberg Pressed Steel Corp., Division of Wunskuck Co., Attleboro, Mass.

WELDERS—Spot and Butt and Welding Wire Fabrics
Eisler Engineering Corp., Newark, N. J.
EVG, Maschinen and Stahl, A.G., Zurich, Switzerland
Herborn Machinery Corporation, Hackensack, N. J.
Micro Products Co., Chicago, Ill.
Schlatter, Ltd., H.A., Zollikon, Zurich

WHEELS—for Printing on Electric Wire
Gem Gravure Company, West Hanover, Mass.
Gillies, Duncan M., Co., Inc., West Boylston, Mass.

WIRE—ACSR
Southwire Co., Carrollton, Ga.

WIRE—Aluminum
Malin & Co., The, Cleveland, Ohio
Southwire Co., Carrollton, Ga.

WIRE—Ball
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Ball & Roller Bearing
Eaton Mfg. Co., Massillon, Ohio

WIRE—Barbed
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.

WIRE—Brass and Bronze
Malin & Co., The, Cleveland, Ohio

WIRE—Brush
Maryland Fine & Specialty Wire Co., Inc., Cockeysville, Md.

WIRE—Building, Electric
Southwire Co., Carrollton, Ga.

WIRE—Bunched and Stranded
Camden Wire Co., Camden, N. Y.
Laribee Wire, Inc., Camden, N. Y.

WIRE—Cadmium
Stamford Processing Co., Peekskill, N. Y.

WIRE—Cold Heading
American Steel & Wire Div., United States Steel Corp., Cleveland Ohio
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Denver, Oakland & New York City.
Continental Steel Corp., Kokomo, Ind.
Detroit Steel Corporation, Detroit, Mich.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Jones & Laughlin Steel Corp., Stainless and Strip Div., Detroit, Mich.
Keystone Steel & Wire Co., Peoria, Ill.
Maryland Fine & Specialty Wire Co., Inc., Cockeysville, Md.
Pittsburgh Steel Co., Pittsburgh, Pa.
Western Wire Corporation, Boston, Mass.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Copper
Camden Wire Co., Camden, N. Y.
Laribee Wire, Inc., Camden, N. Y.
Malin & Co., The, Cleveland, Ohio
Southwire Co., Carrollton, Ga.

WIRE—Coppered Stainless Steel
Western Wire Corporation, Boston, Mass.

WIRE—For Electrical Conductors
Camden Wire Co., Camden, N. Y.
Laribee Wire, Inc., Camden, N. Y.

WIRE—Flat
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
Colorado Fuel and Iron Corporation, Denver, Oakland & New York City.
Jones & Laughlin Steel Corp., Stainless and Strip Div., Detroit, Mich.
Montgomery Co., The, Windsor Locks, Conn.
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Galvanized
American Steel & Wire Div., United States Steel Corp., Cleveland, Ohio
Colorado Fuel and Iron Corporation, Denver, Oakland & New York City.
Detroit Steel Corporation, Detroit, Mich.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Northwestern Steel & Wire Co., Sterling, Illinois
Roebling's, John A. Sons Div., Colorado Fuel & Iron Corp., Trenton, N. J.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—High Carbon
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
Detroit Steel Corporation, Detroit, Mich.
Maryland Fine & Specialty Wire Co., Inc., Cockeysville, Md.
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.

WIRE—Insulated
Southwire Co., Carrollton, Ga.

WIRE—Manufacturers
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, Ohio
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Denver, Oakland & New York City.
Continental Steel Corp., Kokomo, Ind.
Detroit Steel Corporation, Detroit, Mich.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Jones & Laughlin Steel Corp., Stainless and Strip Div., Detroit, Mich.
Keystone Steel & Wire Co., Peoria, Ill.
Maryland Fine & Specialty Wire Co., Inc., Cockeysville, Md.
Northwestern Steel & Wire Co., Sterling, Illinois
Pittsburgh Steel Co., Pittsburgh, Pa.
Republic Steel Corp., Berger Div., Canton, Ohio
Roebling's, John A., Sons Div., Colorado Fuel & Iron Corp., Trenton, N. J.
Rylands Brothers Limited, Warrington, England
U. S. Steel Corp., N. Y., N. Y.
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Metalizing
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
Platt Bros. & Co., The, Waterbury, Conn.
Stamford Processing Co., Peekskill, N. Y.

WIRE—Music
Malin & Co., The, Cleveland, Ohio

WIRE—Needle
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.

WIRE—Nickel Alloy
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.

WIRE—Nickel Silver and Phosphor Bronze
Malin & Co., The, Cleveland, Ohio

WIRE—Oil Tempered
Colorado Fuel and Iron Corporation, Denver, Oakland & New York City.
Detroit Steel Corporation, Detroit, Mich.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Malin & Co., The, Cleveland, Ohio
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A., Sons Div., Colorado Fuel & Iron Corp., Trenton, N. J.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Preheaters
Waico Electric Co., Providence, R. I.

WIRE—for Prestressed Concrete
Rylands Brothers, Limited, Warrington, England

WIRE—Pin
Maryland Fine & Specialty Wire Co., Inc., Cockeysville, Md.

WIRE—Special Shapes
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
Colorado Fuel and Iron Corporation, Denver, Oakland & New York City.
Continental Steel Corp., Kokomo, Ind.
Eaton Mfg. Co., Massillon, Ohio
Jones & Laughlin Steel Corp., Stainless and Strip Div., Detroit, Mich.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Spring
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, Ohio
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Denver, Oakland & New York City.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Jones & Laughlin Steel Corp., Stainless and Strip Div., Detroit, Mich.
Keystone Steel & Wire Co., Peoria, Ill.
Maryland Fine & Specialty Wire Co., Inc., Cockeysville, Md.
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A., Sons Div., Colorado Fuel & Iron Corp., Trenton, N. J.
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Stainless Steel
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, Ohio
Jones & Laughlin Steel Corp., Stainless and Strip Div., Detroit, Mich.
Malin & Co., The, Cleveland, Ohio
Maryland Fine & Specialty Wire Co., Inc., Cockeysville, Md.
Nippon Stainless Steel Wire Mfg. Co., Ltd., Osaka, Japan.
Pittsburgh Steel Co., Pittsburgh, Pa.
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.
Western Wire Corporation, Boston, Mass.

WIRE—Steel—Also Coppered and Galvanized Steel
American Steel & Wire Div., United States Steel Corp., Cleveland, Ohio
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Denver, Oakland & New York City.
Continental Steel Corp., Kokomo, Ind.
Detroit Steel Corporation, Detroit, Mich.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Malin & Co., The, Cleveland, Ohio
Maryland Fine & Specialty Wire Co., Inc., Cockeysville, Md.
Northwestern Steel & Wire Co., Sterling, Illinois
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A., Sons Div., Colorado Fuel & Iron Corp., Trenton, N. J.
Rylands Brothers, Limited, Warrington, England
U. S. Steel Export Co., New York, N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Straightening and Cutting
Colorado Fuel and Iron Corporation, Denver, Oakland & New York City.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Stranded & Bunched
Laribee Wire, Inc., Camden, N. Y.

WIRE—Tinned
Camden Wire Co., Camden, N. Y.
Laribee Wire, Inc., Camden, N. Y.

WIRE—Zinc
Platt Bros. & Co., The, Waterbury, Conn.
Stamford Processing Co., Peekskill, N. Y.

WRAPPING PAPER—Creped
(See PAPER-Creped Wrapping)

YARN TESTERS—
Scott Testers, Inc., Providence, R. I.

YARNS—Wire Insulating
Chadwick Yarn Company, Pawtucket, R. I.
Synthetic Thread Co., Bethlehem, Pa.

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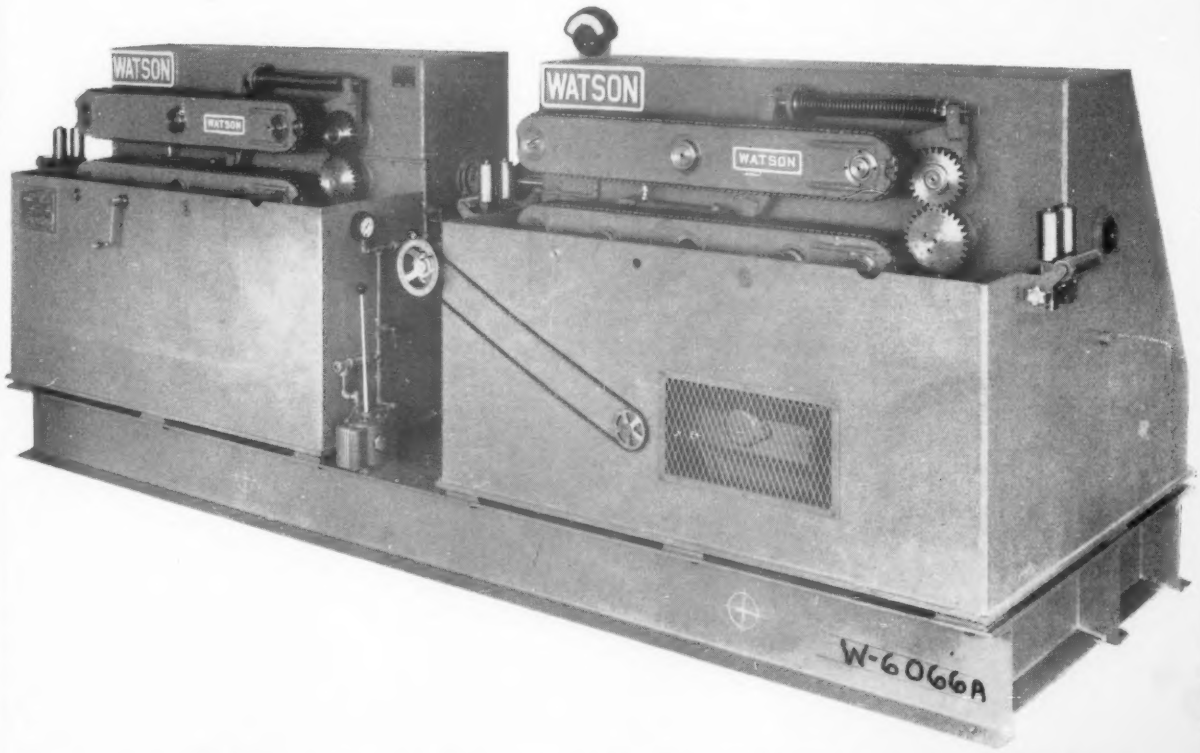

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